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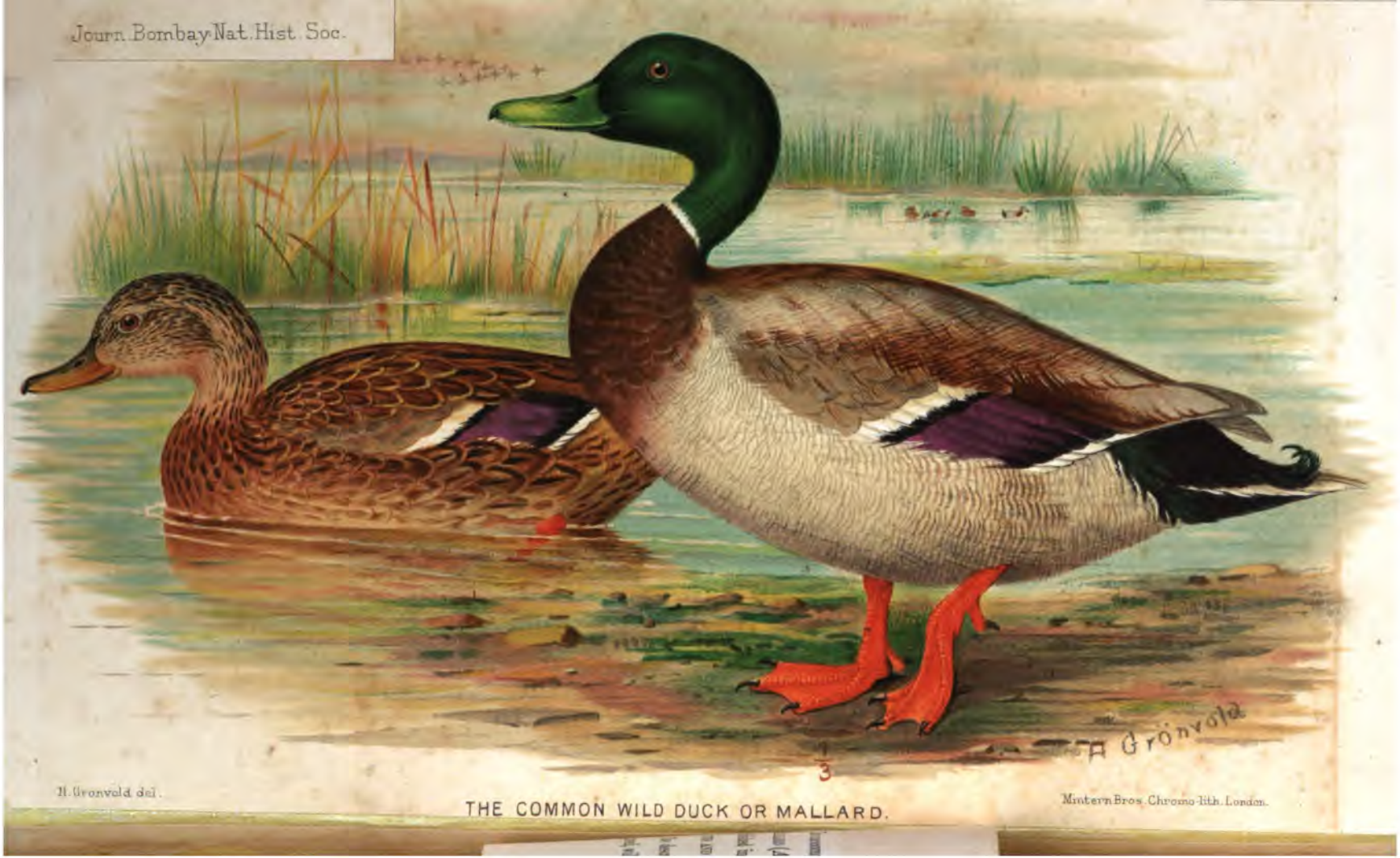

H. Grönvold del.

THE COMMON WILD DUCK OR MALLARD.

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NOTICE.

The accompanying plate (No. XV) of THE COMMON WILD DUCK OR MALLARD (*Anas boscas*) is in continuation of the series of Plates already published in this Journal in connection with the paper on "INDIAN DUCKS AND THEIR ALLIES," by Mr. E. C. Stuart Baker.

The description of "THE COMMON WILD DUCK OR MALLARD" now figured, will be found on pages 1 to 10 of VOL. XII of this Journal.

EDITORS.

bright red ; abdomen red, the 3rd and 4th segments reddish black ; pubescence sparse, greyish black; wings hyaline, infuscated at apex, radial cell very short, its apex not reaching beyond the apex of the 3rd cubital cell, stigma dark testaceous, nervures and tegulæ pale testaceous.

♂ Differs from the ♀ as follows : less conspicuously shining, front and mesonotum minutely but sparsely punctured, pubescence grey, longer and denser, abdomen often reddish black ; wings clear hyaline, their apices not infuscated, stigma less dark.

Long. ♀ 5-5 *mm.* ♂ 7 *mm.*

HABITAT : Quetta.

Journ. Bombay Nat. Hist. Soc.

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Natural History Society.

Vol. XV. BOMBAY. No. 1.

NEW SPECIES OF INDIAN HYMENOPTERA.

By Major C. G. Nurse, 13th Bombay Infantry.

The following new species belong to the family Sphegidæ. The most interesting are two species of the little known genus Homogambrus, of which the ♀ has not previously been described. Three species of the genus Palarus have also been included below; in the Indian region this genus has hitherto only been recorded from Ceylon. Two species in the following paper were sent me by Mr. G. C. Dudgeon, who also forwarded their descriptions in M.S. His notes on *Stigmus cuculus* are particularly interesting, as his observations confirm those of Geraud that certain species of this genus store their nests with Aphidæ.

Astata quettæ n. sp.

♀ Smooth and shining, except the median segment, which is finely longitudinally striate; front very convex, pronotum somewhat long, median segment gradually narrowed and rounded posteriorly. Black; the apices of the femora, and the whole of the tibiæ and tarsi bright red; abdomen red, the 3rd and 4th segments reddish black; pubescence sparse, greyish black; wings hyaline, infuscated at apex, radial cell very short, its apex not reaching beyond the apex of the 3rd cubital cell, stigma dark testaceous, nervures and tegulæ pale testaceous.

♂ Differs from the ♀ as follows: less conspicuously shining, front and mesonotum minutely but sparsely punctured, pubescence grey, longer and denser, abdomen often reddish black; wings clear hyaline, their apices not infuscated, stigma less dark.

Long. ♀ 5-5 *mm.* ♂ 7 *mm.*

Habitat: Quetta.

This species is nearest to *A. lubricata* (Nurse) described from Deesa, but differs in the sculpturing, and in the greater part of the femora being black, and not red. I have several specimens of the ♂, but only one of the ♀, and as it is much smaller than the other sex, it may be an unusually small specimen.

HOMOGAMBRUS CREON, n. sp.

♂ Clypeus and front smooth and shining, mesonotum, scutellum, and post scutellum sparsely punctured, median segment striate, the striations longitudinal at base, oblique at the sides, almost semicircular at apex in the centre, abdomen minutely punctured ; front above the base of antennæ raised almost tuberculate, median segment roundly truncate posteriorly, abdomen scarcely as long as thorax. Black; the mandibles, legs, and apical abdominal segment red ; the apical margins of the abdominal segments very narrowly reddish ; pubescence silvery, in some lights with a golden tinge, especially on the clypeus and front; the bases of 1st and 2nd abdominal segments more or less pruinose ; wings hyaline, nervures and tegulæ pale testaceous.

Long. 6-7 *mm.*

HABITAT : Deesa, five specimens : Quetta, one specimen. The latter has the whole abdomen red, but does not appear to differ in other respects from the Deesa specimens, and I conclude it must be the same species.

This genus has not previously been recorded from India, in fact only a few species are known.

HOMOGAMBRUS MENELAUS, n. sp.

♀ Front minutely but not very regularly, vertex and thorax more coarsely punctured, median segment finely reticulate, abdomen minutely punctured ; head broader than the thorax, clypeus very prominent and convex, its apical margin nearly transverse, with two notches in the centre ; the portion of the front above the base of antennæ raised, smooth and shining ; eyes convergent towards the vertex, but not meeting, their distance apart at vertex being about half as much again as the distance of the anterior ocellus from the margin of the eyes ; posterior ocelli flattened, but not obsolete ; antennæ with the scape as long as the 2nd and 3rd joints of the flagellum united, the second being slightly the longer ; median segment with a semicircular portion at base reticulate ; abdomen scarcely longer than thorax, apical segment with a smooth and not very clearly defined pygidium.

Black and shining; the apical margins of the abdominal segments, the tibiæ and tarsi, testaceous: a little short, golden, pubescence on the clypeus and front; wings hyaline, nervures and tegulæ pale testaceous.

Long. 4—5-5 *mm.*

HABITAT: Peshin, Baluchistan, three specimens; Deesa, one specimen. The latter, however, differs from the Peshin specimen in having the whole of the legs red, and the apical margins of the abdominal segments not testaceous. The appendicular nervure is also more clearly defined. But the sculpture does not appear to differ from that of the other specimens, and I think that it is the same species.

No ♀ of this genus has, I believe, been hitherto described, but, although I have not obtained a ♂ of this species, I have little doubt that I have correctly placed it. It is too small to be the other sex of *H. creon* above.

TACHYTES DILWARA, n. sp.

♀ Head and thorax extremely minutely and closely punctured, abdomen minutely aciculate; clypeus convex, transverse anteriorly; an impressed line from between bases of antennæ through anterior ocellus to vertex; median segment with a median longitudinal furrow. Black; the greater part of the femora, and the whole of the tibiæ and tarsi red; pubescence on clypeus, front, and legs golden, on the thorax and base of first abdominal segment greyish and somewhat sparse, except on the median segment; pile on abdomen silvery, a few stiff, black hairs on apical abdominal segments, pygidium with stiff golden-red and black hairs intermingled, appearing golden-red when viewed obliquely; wings flavo-hyaline, nervures pale testaceous, tegulæ red; third cubital cell much narrowed, narrower than the second both above and below.

Long. 12-16 *mm.*

HABITAT: Mount Abu.

Nearest to *T. modesta*, from which it can be distinguished by the hairs on the pygidial area being black and golden-red, not silvery.

TACHYTES SHIVA, n. sp.

♀ Differs from *T. dilwara* above only in the median segment being shorter and the whole of the legs being black, not red; the legs are covered with golden pile, and the spines are testaceous red, as in *T. dilwara*.

Long. 16 *mm.*

HABITAT. Deesa; Mount Abu.

LARRA NEÆRA, n. sp.

♀ Head shining, the clypeus and vertex minutely and closely punctured, the extreme apex of the clypeus impunctate; mesonotum, scutellum, and postscutellum rather more deeply and less finely punctured than the head, median segment finely transversely striate, with punctures between the striæ; abdomen shining, the bases of the segments extremely minutely punctured, their apices impunctate; apex of clypeus waved, scarcely emarginate; front above the antennæ with three sulcations, impunctate and very shining; ocellus situated in a hollow, another and slighter hollow where the posterior ocelli should be; mesonotum with a slight impressed median longitudinal line at base; median segment roundly truncate posteriorly, with a trace of a longitudinal carina; pygidium with a few scattered punctures. Black; the greater part of the mandibles, the intermediate and posterior femora and tibiæ red; all the spines of the legs more or less rufo-testaceous; scarcely any pubescence except on the thorax below, where it is short and greyish; wings fusco-hyaline, the hind wing at base hyaline, nervures dark testaceous, tegulæ rufo-testaceous.

Long. 13-17 *mm.*

HABITAT: Quetta.

Allied to *L. erratica*, but may be distinguished from it by having the intermediate femora and tibiæ, and the posterior tibiæ, red and not black.

PALARUS INDICUS, n. sp.

♂ Clypeus with a few shallow punctures, front, vertex, and pronotum impunctate, mesonotum and scutellum sparsely punctured, postscutellum impunctate, median segment with oblique, almost semicircular, striations, abdomen sparsely and shallowly punctured; mandibles with a wide incision on their outer margin, eyes at vertex about as far apart as the length of the third joint of the antennæ; clypeus small, very convex, nearly semicircular, its apex rounded; front with the portion between the base of antennæ and the ocelli much raised, almost tuberculate, with a median longitudinal impressed line; anterior ocellus large and round, situated in a deep hollow; posterior ocelli elongate-oval, with a fovea between them; antennæ with the scape short and stout, the third joint the longest, fourth and fifth subequal; pronotum moderately wide, depressed in the centre; median segment rounded in the middle posteriorly, with a wide median depression, deepest posteriorly,

the lateral angles slightly raised and very conspicuous; abdomen longer than the head and thorax united, first ventral segment with two conspicuous tubercles, third ventral segment very much produced below, seventh ventral segment with two small tubercles, pygidium elongate, with a deep median groove, its apex notched; a little short, sparse, silvery pubescence on the front, cheeks, legs, and apical abdominal segments. Head with the clypeus, anterior portion of front, vertex, and occiput black; antennæ yellow at base, gradually becoming red at apex; thorax black, the pronotum yellow, tubercles and a spot above them yellowish red, scutellum and postscutellum red; abdomen yellow, the first segment and the depressed portions of the remaining segments, including the pygidium, light red; the margins of all the segments when extended very narrowly black; legs red. Forewing flavo-hyaline, its apical margin lighter, the portion about the appendicular cell infuscated; hindwing lighter flavo-hyaline, its margin hyaline; nervures testaceous, tegulæ reddish yellow; second cubital cell very slightly stalked, third cubital cell reaching just beyond the apex of the radial cell; both recurrent nervures received into the second cubital cell, the first just within its inner angle, the second one-third the length of the cell on the cubital nervure from its outer angle.

Long. 16 *mm.*

HABITAT: Deesa; a single specimen.

PALARUS QUIESCENS, n. sp.

♀ Clypeus with a few shallow punctures, front impunctate; mesonotum minutely and closely punctured at the sides, sparsely and coarsely in the centre, scutellum with a few scattered punctures; median segment striate, the striæ longitudinal at base, oblique at the sides, transverse at apex; abdomen finely and closely, but somewhat irregularly, punctured; the distance apart of the eyes at vertex is about the length of the third joint of the antennæ, which is the longest; clypeus small, convex, its anterior margin rounded, from its posterior margin to the anterior ocellus runs a conspicuous ridge; anterior ocellus the largest, the posterior ones oval; pronotum narrow, and depressed below the level of the mesonotum; median segment below the level of the postscutellum, its posterior lateral angles raised and conspicuous; pygidium long and narrow, impunctate, with its margins raised; ventral segments not produced below. Yellow; the tips of the mandibles, two irregular marks on the front between the base of antennæ and the

vertex, the mesonotum, except a U-shaped marked, a spot behind the tegulæ, the base and median furrow of the median segment, the base and apex of the abdominal segments, and small round lateral spots on the latter, black; antennæ and the bases and apices of some of the abdominal segments more or less red; pygidium yellow at base, red at apex; a little silvery pile on the front; wings hyaline, nervures testaceous, tegulæ yellow; the appendicular cell is not very clearly marked, the third cubital cell reaches considerably beyond the radial cell, the third cubital nervure being received near the apex of the radial cell, which is broadly rounded; the second cubital cell, which is only very slightly stalked, receives both recurrent nervures, the first well within its inner angle, and the second at a slightly greater distance from its outer angle.

♂ Differs from the ♀ as follows: first ventral segment with two small tubercles, second ventral segment much produced below, pygidium shorter, much broader, tridentate at apex, the middle tooth slightly, but not much, longer than the lateral ones; the third cubital nervure is received further from the apex of the radial cell and the first recurrent nervure is interstitial, or nearly so, with the first transverse cubital nervure.

Long. 8-10 *mm.*

HABITAT: Deesa; five specimens. One ♀ has the yellow markings much less developed than the others, and the greater part of the thorax, especially below, is black.

PALARUS FABIUS, n. sp.

♀ Allied to *P. quiescens* above, but differs as follows: smaller and less robustly built comparatively, mesonotum impunctate, abdomen more sparsely punctured, thorax with long silvery pubescence, no U-shaped mark on mesonotum, and less yellow on the thorax generally; wings with the nervures paler testaceous, the first recurrent nervure interstitial with the first transverse cubital nervure; all the femora and sometimes the tarsi more or less red.

♀ Smaller than the same sex of *P. quiescens;* the front, except the clypeus, black, thorax darker and without the U-shaped mark on the mesonotum; the black markings of the abdomen more developed, pygidium with the central tooth much longer than the lateral ones, all the femora more or less black.

Long. 6-8 *mm.*

HABITAT: Deesa.

The above three species are easily distinguished from *P. orientalis*, the only species previously recorded from the Indian region, by the much greater convergence of the eyes.

MISCOPHUS QUETTAENSIS, n. sp.

♀ Head, thorax, and abdomen very minutely and closely punctured, median segment finely obliquely striate; clypeus slightly raised in the centre, its apex almost transverse; front with a median longitudinal impressed line; abdomen scarcely longer than thorax. Black, with bronzy reflections; basal two abdominal segments dark red; head, thorax, apical portions of abdominal segments, and legs with sparse, short, silvery pile; wings hyaline, their apices slightly infuscated.

♂ Similar, slightly smaller, abdomen longer in proportion, the segments slightly constricted, front with golden pile.

Long. 5 *mm.*

HABITAT: Quetta; two specimens.

This species may be easily known from both *M. rothneyi*, and from *M. difficilis* described below, by its being punctured.

MISCOPHUS DIFFICILIS, n. sp.

♀ ♂ Head, thorax, and abdomen smooth and shining; clypeus much broader than long, rounded anteriorly; front between base of antennæ and anterior ocellus with a longitudinal impressed line; median segment rounded posteriorly, with a trace of a median longitudinal furrow, the segment microscopically striate at base, the striæ oblique at the sides, transverse in the centre. Black; the scape of the antennæ, the tibiæ, and tarsi red; wings hyaline, forewing fuscescent along the costal margin, nervures and tegulæ black.

Long. 3-4 *mm.*

HABITAT: Peshin, Baluchistan; six specimens.

This is, I believe, the smallest species yet described.

GASTROSERICUS ELECTUS, n. sp.

♀ Head and thorax minutely aciculate, abdomen smooth; clypeus much broader than long, emarginate anteriorly; median segment rounded posteriorly; pygidium with a few scattered punctures. Head and thorax black; the base of the mandibles, clypeus, the greater part of the scape and sometimes the flagellum of the antennæ, the abdomen, the greater part of the femora, and the whole of the tibiæ and tarsi, red; head, thorax, and abdomen covered with a short, silvery pile,

which in some lights has a golden tinge; pygidium without pubescence (possibly abraded); wings hyaline, nervures testaceous, tegulæ red.

Long. 5-6 *mm.*

HABITAT: Deesa; three specimens.

Of the four Indian species hitherto described, three, *viz.*, *G. rothneyi*, *G. wroughtoni*, and *G. rufitarsis* can be at once distinguished from the present species by their much larger size; *G. binghami* has the legs more or less yellow; *G. waltlii* from Egypt has the abdomen chiefly black, and is much larger.

TRYPOXYLON MEDIATOR, n. sp.

♀ Head, thorax, and abdomen impunctate, median segment with the basal half somewhat coarsely reticulate; clypeus much produced anteriorly, its margin rounded, and reaching well below the lower margin of the eyes; antennæ close together at base, inserted some distance above the posterior margin of clypeus; the second joint of the flagellum the longest, slightly longer than the apical joint; emargination of the eyes deep but narrow, distance of eyes apart at posterior margin of clypeus only half their distance apart at vertex; a deep furrow from anterior ocellus to base of antennæ, the portion of the front on either side of it and just in front of anterior ocellus much raised; median furrow of median segment not conspicuous, no lateral furrows; first abdominal segment very long, slightly longer than second and third united, the two latter subequal. Black; the mandibles, base of the tibiæ, calcaria, and the tarsi more or less rufo-testaceous; pubescence silvery, very thick on clypeus and front; wings hyaline, nervures black, tegulæ testaceous; the radial cell conspicuously long.

♂ Similar, smaller, the antennæ longer, their apical joint curved and pointed; the intermediate and posterior tarsi rufo-testaceous only at the bases of the joints.

Long. 7-10 *mm.*

HABITAT: Quetta; several males and one female. The latter I found nesting in a hole in the trellis work of my verandah.

Of the Indian species the present is nearest to *T. cognatum*, but may be distinguished by the median segment being reticulate and not striate.

AMMOPHILA BOLANICA, n. sp.

♀ Head, pronotum, mesonotum, and scutellum posteriorly somewhat sparsely punctured, scutellum posteriorly finely but obscurely

striate, median segment finely and regularly rugose, abdomen smooth and shining; eyes with their inner orbits nearly parallel, clypeus broader than long, arched anteriorly; posterior ocelli nearer to one another than to the margin of eyes; antennæ with the third joint the longest, but not so long as the fourth and fifth united; pronotum rather long, mesonotum with a median longitudinal line at base; median segment gradually sloping for about two-thirds of its length, then perpendicular, its posterior margin rounded; petiole short, formed of the first segment only, second segment gradually widening to apex, about the same length as the first, and rather longer than the third abdominal segment. Black; the abdomen very shining; front, scape of the antennæ, cheeks, thorax, and femora covered with long but not very dense black pubescence; legs very spinose; forewing subfuscous, hindwing rather lighter, the first discoidal nervure is received nearly in the middle of the second cubital cell.

Long. 16-17 *mm.*

HABITAT; Quetta; four specimens.

I first saw this insect in the Bolan Pass on my way to Quetta. It is allied both to *A. læta* described from Chaman, South Afghanistan, and to the European species *A. ebenina*, which extends into Persia, but it differs from both in being smaller and in the sculpture of the median segment.

AMMOPHILA FUNEREA, n. sp.

♂ Clypeus almost impunctate, vertex of head sparsely punctured, pronotum impunctate, mesonotum obliquely, scutellum and post scutellum longitudinally, and median segment transversely striate; abdomen impunctate, the first two segments shining; clypeus much produced, its anterior margin transverse, a conspicuous median longitudinal carina not reaching the anterior margin; distance of eyes apart at vertex about half as much again as at clypeus; posterior ocelli rather closer together than their distance from margin of eyes; antennæ with the second joint of the flagellum the longest, apical five joints widest in the middle; pronotum wide, not or scarcely notched; the striation of the median segment much coarser at the sides than above; petiole formed of the first abdominal segment only, second segment gradually widened towards apex, where, however, it is much narrower than the base of the third segment; legs stout, tarsal claws bidentate. Black; antennæ, abdomen, and legs pruinose; front with

a very little whitish pile, cheeks and thorax in front and at the sides with a little greyish to fuscous pubescence ; wings hyaline.

Long. 23 *mm.*

HABITAT : Deesa ; a single specimen.

This species, having the tarsal claws bidentate, belongs to the subgenus Parapsammophila, of which the only other Indian representative is *A. erythrocephala*. The latter species has, however, the wings fuscous and the legs red.

SPHEX FRAGILIS, n. sp.

♀ Head and thorax with thick but rather short white pubescence, hiding the sculpturing, except on the median segment, which is finely transversely striate ; clypeus broader than long, its anterior margin rounded, with a very slight emargination in the centre ; inner margins of eyes parallel, cheeks and occiput moderately developed, mandibles very long, simple at apex ; second joint of flagellum of antennæ half as long again as the third ; pronotum rather long, mesonotum with an impressed line at base, scutellum notched, but not postscutellum ; median segment rather long, gradually sloping, rounded posteriorly, without any longitudinal furrow ; petiole of abdomen rather shorter than second and third segments united, remaining segments forming an elongated oval ; ventral plates of abdomen not pubescent or punctured ; legs long, slender, the tarsi strongly spinose, claws bidentate. Black ; the mandibles in the centre, tegulæ, second and following abdominal segments, apex of femora, tibiæ, and tarsi, rather light red ; the abdominal segments have at apex bisinuate bands of lighter colour; many of the spines of the legs are white ; wings hyaline, nervures testaceous; second cubital cell higher than long, rhomboidal, third much narrowed above, sub-triangular ; the first recurrent nervure is interstitial with the first transverse cubital nervure, the second recurrent nervure is received into the third cubital cell near the inner angle.

♂ Smaller, clypeus more produced, eyes very slightly divergent at vertex, all the legs, and the second and basal half of the third abdominal segments black ; the second abdominal segment with thick white pubescence.

Long. ♀ 17 *mm.* ♂ 13 *mm.*

HABITAT : Deesa ; Quetta.

This species looks like a miniature *S. nivosus*, but it is less than half the size, and differs in other respects.

SPHEX RETRACTUS, n. sp.

♂ Head and thorax with rather thick but short pubescence, which hides the sculpturing, abdomen pruinose; clypeus longer than broad, very convex, its anterior margin nearly transverse in the centre, rounded at the sides; eyes slightly divergent towards vertex, occiput and cheeks not much developed; mandibles simple, rather long and slender; second joint of flagellum of antennæ longer than third; pronotum short, not notched; scutellum notched, but not postscutellum; median segment long, gradually sloping, narrowed and rounded at apex, without a furrow, coarsely but obscurely transversely striate; petiole rather longer than the second segment, which is subequal to the third in length; ventral segments not pubescent or punctured: legs long, slender, rather feebly spined, the claws bidentate, the inner calcar of posterior tibiæ pectinated. Black; the apical margins of the abdominal segments sometimes very narrowly testaceous, the abdomen below red; pubescence and pile greyish white; wings hyaline, their apical margins very slightly infuscated.

Long. 15-17 *mm.*

HABITAT: Quetta; three specimens.

In Bingham's key this species would come next to *S. nivosus*, but it is not very nearly allied to that species. Of the European species it appears to come nearest to *S. argentulus* (Fabr.), but it is much smaller, the wings are not dark at base, and the pubescence is greyish white, not black.

PSEN REFRACTUS, n. sp.

♀ Clypeus and front with the sculpturing hidden by the pubescence, vertex of head impunctate, mesonotum finely, sparsely, and shallowly punctured, abdomen smooth and shining; clypeus broader than long, its anterior margin rounded, with a very slight incision in the centre; inner margin of eyes rounded, the width apart of eyes at vertex being slightly greater than below; antennæ inserted about the length of the third joint of the flagellum above the posterior margin of the clypeus, strongly clavate, the second joint of the flagellum half as long again as the third, front with a carina between the antennæ; cheeks strongly developed; pronotum short, below the level of the mesonotum, the latter broader than long, rounded anteriorly; median segment with a triangular portion at base depressed, the depressed portion longitudinally striate, and produced into a somewhat narrow

median furrow, the sides of the median segment rounded, obscurely reticulate; petiole shorter than thorax, remainder of abdomen as long as head, thorax, and petiole united; pygidium punctured. Black; the mandibles in the centre, the second and third abdominal segments, and sometimes the margins of the remaining segments, dark red; tibiæ at base and the whole of the tarsi more or less testaceous, calcaria pale; clypeus and front covered with short, silvery pubescence; thorax, femora below, and apical two or three segments of abdomen with longer, sparse, greyish pubescence; wings hyaline, the first recurrent nervure is received into the second cubital cell before the middle, the second recurrent nervure into the third cubital cell just beyond its inner angle.

Long. 12 *mm.*

HABITAT: Mount Abu; three specimens.

This species belongs to Cameron's Annulipes group. Of the Indian species it comes next to *P. reflventris*, but can easily be distinguished from it by the petiole being shorter than the thorax, whereas in rufiventris it is as long as head and thorax united.

STIGMUS CUCULUS, n. sp. (*Dudgeon M. S.*)

"♀ Differs from *S. congruus* (Walk.) in being less than half the "size, in the whole of the antennæ being testaceous, clypeus subtrian-"gular and slightly produced; tubercles not white.

"*Long.* 3-5 *mm.*

"HABITAT: Holta, Kangra Valley.

"This small insect nests in the holes bored in soft pine by a minute "species of beetle. It stores its nest with aphidæ, and lives in colonies "of thirty or forty together. My specimens were procured from a table "in my verandah, where I had many opportunities of watching their "habits. It is much smaller than the other two Indian species of the "genus."

PASSALŒCUS DUDGEONI, n. sp.

♀ Head and mesonotum finely and closely punctured, median segment finely reticulate, abdomen impunctate or nearly so; clypeus broader than long, subtriangular, its anterior margin rounded, labrum triangular, mandibles blunt at apex; eyes divergent towards the vertex, their distance apart there being half as much again as at the base of antennæ; front without tubercles, scape of antennæ as long as the first four joints of the flagellum united, these latter joints being subequal, apical joint of flagellum the longest; mesopleuræ with a

single furrow; median segment rounded posteriorly, abdomen rather longer than thorax, petiole very short, second segment the longest, second and third segments constricted at apex. Black; the scape of the antennæ, tubercles, apex of all the femora, the greater part of the tibiæ, and all the tarsi more or less yellow; the first two joints of the flagellum testaceous; wings hyaline and iridescent, nervures dark brown, tegulæ yellowish; clypeus, front, and cheeks with short, stiff, silvery pubescence.

Long. 5 *mm.*

HABITAT: Kangra Valley, Punjab, 4,500ft; two specimens sent me by Mr. G. C. Dudgeon.

This species is easily distinguished from *P. levipes* by its smaller size, and by the median segment being reticulate. It is near to *P. reticulatus* (Cam.), but has no keels on the head.

DIODONTUS TENUIS, n. sp.

♀ ♂ Head with a few scattered punctures, mesonotum and abdomen smooth and shining, median segment finely rugose; clypeus with the anterior margin rounded, with a deep notch in the centre, eyes slightly divergent towards the vertex, cheeks strongly developed; posterior ocelli further apart from one another than from the margin of eyes; antennæ short, stout, the third joint of the flagellum slightly the longest, remainder subequal; median segment narrowed and rounded posteriorly. Black; the mandibles, except their tips, the scape of the antennæ, apex of the femora, and the whole of the tibiæ and tarsi pale yellow; the flagellum of the antennæ red; clypeus and front (♂) with short, thick, silvery pubescence; wings hyaline and iridescent, nervures black, tegulæ pale testaceous.

Long. 3—3·5 *mm.*

HABITAT: Quetta; Peshin; five specimens.

Two species of this genus have been described from India by Mr. Cameron, *viz. D. geniculatus* and *D. striolatus*. From the former the present species may be distinguished by the tibiæ and tarsi being yellow; from the latter by the antennæ being red, not black. The only European species with yellow mandibles, *D. minutus* (Fabr.) has also the antennæ black.

DIODONTUS SELECTUS, n. sp.

♀ Head, thorax, and abdomen almost smooth, with a few scattered punctures, median segment finely reticulate; clypeus with three

minute teeth anteriorly ; eyes with their inner orbits parallel, cheeks strongly developed, as broad as the eyes or nearly so ; anterior ocellus closer to the posterior ones than the latter are to one another ; median segment laterally with a small tubercle. Black ; the mandibles and the tibiæ and tarsi yellow, the tibiæ darker in the centre ; wings hyaline, nervures and tegulæ testaceous.

♂ Similar ; clypeus and front with silvery pubescence, flagellum of antennæ pale below, eyes divergent towards vertex.

Lmg. 4-5 *mm.*

HABITAT : Deesa ; Quetta ; Peshin ; six specimens.

This species is nearest to *D. geniculatus*, but may be separated from it by the lateral tubercles on the median segment.

DIODONTUS RUSTICUS n. sp.

♂ Head rather closely and coarsely punctured, the punctures on the front running into striæ, thorax sparsely punctured, median segment reticulate abdomen microscopically with minute and not very close punctures ; clypeus with the anterior margin rounded, labrum notched ; eyes divergent towards the vertex, cheeks well developed ; antennæ long, filiform, the apical joint the longest. Black ; the tibiæ and tarsi more or less pale testaceous, the latter darker in the middle ; front with thick silvery pubescence ; wings hyaline, nervures black, tegulæ pale testaceous.

Long. 5 *mm.*

HABITAT : Quetta ; Peshin ; six specimens.

The only Indian species hitherto described which has black mandibles.

GORYTES INTRUDENS, n. sp.

♀ Impunctate, or nearly so, except the scutellum and median segment, which are somewhat sparsely and shallowly punctured ; eyes convergent below, their width apart at vertex being about twice that at base of antennæ, their facetting fine and regular ; ocelli very small, the distance apart of the posterior ones being greater than their distance from the margin of eyes ; clypeus broader than long, its anterior margin produced and almost transverse ; antennæ long, filiform, inserted not much above the posterior margin of clypeus, the second joint of flagellum the longest, third and following joints gradually decreasing in length to apex ; cheeks well developed, their width being more than half the width of the eyes ; pronotum narrow, mesosternum

sharply defined laterally, almost carinate; median segment gradually sloping towards apex, with a triangular sharply defined enclosed space, the latter with outwardly divergent striæ; anterior tarsi with long spines; abdomen longer than head and thorax united, first segment not petiolate, but gradually widening towards apex, where it is as wide as the base of the second segment; second segment about as long as the first, with a deep transverse furrow at base ventrally; pygidium shaped like an isosceles triangle, sparsely punctured. Dark red; the front, vertex, and apical two or three joints of the antennæ black; scutellum, postscutellum, and a broad apical band on second abdominal segment yellow; the enclosed space at the base of median segment, the femora above, a median narrow band on second, and the base of the third abdominal segments blackish; slightly pruinose, with a little sparse silver pile on clypeus and median segment; wings sub-hyaline, with a dark fuscous cloud covering the whole of the radial and the greater part of the second and third cubital cells, stigma very light testaceous, nervures testaceous, tegulæ red; the first recurrent nervure is received into the second cubital cell near the middle, the second near its outer angle; medial cell of hindwing very long, nearly twice the length of anal cell.

♂ Similar, the antennæ longer, anterior tibiæ and tarsi yellow.

Long. 8 *mm.*

HABITAT: Mount Abu; five specimens.

Having the eyes convergent below, this species would come into Bingham's key under "A," but it is not very near any of the other species in that section. Superficially it somewhat resembles *G. capitatus* (Nurse), but the yellow markings are fewer, and the eyes are much more strongly convergent below. The very small ocelli serve to distinguish it at once from *G. capitatus*, in which species the ocelli are quite three times as large as in the present species.

GORYTES IMPUDENS, n. sp.

♂ Smooth and impunctate, covered with some sparse, white pubescence; eyes with their inner margins parallel, the facetting fine and regular; ocelli large, the posterior ones distant from the margin of eyes about half as much as their width apart; clypeus very short and broad, its interior margin slightly arched; antennæ long, inserted close above the posterior margin of clypeus, apical joint the longest, curved and pointed, the three joints preceding it somewhat thickened; cheeks moderately developed; median segment with a well-defined

triangular enclosed space, produced at apex into a longitudinal furrow, the enclosed space reticulate, sides of the segment well rounded ; first abdominal segment not petiolate, about as long as second, the latter has no transverse ventral furrow ; pygidium small, with a few punctures. Head black, the clypeus and front to just above the base of antennæ and the scape pale yellow ; mandibles and flagellum of antennæ more or less red ; thorax red, the enclosed space of median segment and its furrow black ; abdomen black, first segment with two oval sublateral apical spots, second with an apical band much narrowed in the middle, and fifth segment pale yellowish white, ventrally entirely black ; legs black, the anterior and intermediate femora red below, and the anterior tarsi reddish ; a yellow or yellowish white line on all the tibiæ above ; wings subhyaline, first cubital nervure received into second cubital cell just before its middle ; median cell of hindwing about twice as long as anal cell.

Long. 6 *mm.*

HABITAT : Mount Abu ; a single specimen.

Nearest to *G. pictus*, but may easily be distinguished from it by the absence of the fuscous patch in the forewing.

CRABRO BALUCHA, n. sp.

♀ Head finely and closely, thorax less finely, abdomen extremely, minutely and closely punctured ; eyes widely divergent towards vertex, their distance apart there being at least four times that near base of antennæ ; facetting of eyes not regular, being coarser towards their inner margin below ; mandibles without a notch on their outer margin, bidentate at apex ; clypeus much broader than long, convex in the centre, with a conspicuous longitudinal carina, its anterior margin bi-emarginate ; flagellum of antennæ with all the joints subequal, first and second narrowed at base ; cheeks nearly as broad as eyes ; posterior ocelli about as far apart as their distance from inner margin of eyes ; pronotum comparatively broad, notched in the centre, raised above the level of anterior margin of mesonotum ; median segment small, somewhat narrowed posteriorly, rather steeply sloped, rugose at the sides and apex, with no enclosed space at base, but with a narrow median longitudinal furrow, which becomes slightly broader at apex ; abdomen with the first segment not petiolate, but narrowed at base, becoming gradually wider towards apex, about equal in length to the second and third segments united ; pygidium long, narrow, pointed, bare,

with a few scattered punctures. Black; the abdomen shining; the mandibles, except their tips, the scape and the first one or two joints of the flagellum of antennæ, the pronotum, tubercles, scutellum, postscutellum, a spot on the coxæ below (frequently obsolete), all the femora, tibiæ, and tarsi, broad bands on the second, fourth, and fifth abdominal segments, and sometimes also on the third segment bright yellow; the tarsi at apex more or less inclining to ferruginous; clypeus with short, thick, silvery pubescence, remainder of head, thorax, and apical abdominal segments with short, sparse, greyish pile: wings subhyaline, nervures and tegulæ testaceous, cubital nervure received into the radial cell just before its middle.

♂ Similar; antennæ 12-jointed as in the ♀, but with joints 2-6 of the flagellum very much thickened, being about three times as wide as the scape; anterior tarsi slightly thickened, whitish; scutellum and postscutellum black, not yellow; abdomen with yellow bands on second to sixth segments, apical abdominal segment when extended smooth, emarginate at base, with stiff greyish hairs at apex.

Long. 6-8 *mm.*

HABITAT: Quetta; common.

This species belongs to the Thyreopus group, and having no enclosed space at base of median segment, it is not very near to any of the Indian species. It makes its nest in hollow reed-stems, and stores common house flies for its progeny. I saw a ♀ go into a reed-stem, which I then cut off, and bred several specimens of both sexes from it.

CRABRO PROSOPIFORMIS, n. sp.

♀ Smooth and shining, with a few scattered punctures on the head and mesonotum; eyes at vertex more than twice their width apart near base of antennæ; facetting of eyes coarser near inner margin below than elsewhere; mandibles not notched below, their apices simple; clypeus with the anterior margin produced and rounded in the middle; antennæ with the joints of flagellum subequal, not thickened; posterior ocelli much further apart from one another than from inner margin of eyes; cheeks strongly developed, nearly as wide as eyes; pronotum narrow, notched, below the level of mesonotum; median segment with a narrow triangular space at base depressed and longitudinally striate, its apex produced into a median furrow, into which two lateral furrows join; abdomen slightly longer than thorax, not petiolate, the first segment only slightly longer than the second; pygi-

dium shaped like an isosceles triangle. Black ; the mandibles, except their tips, scape of antennæ, pronotum, tubercles, scutellum usually, apex of anterior and intermediate femora, and the whole of the tibiæ and tarsi yellow ; flagellum of antennæ below ferruginous, pygidium red ; clypeus with rather long silvery pubescence, remainder of head, thorax, and abdomen with a little sparse, greyish pile ; wings hyaline, stigma dark, nearly black ; nervures dark testaceous, tegulæ light testaceous ; the cubital nervure is received into the radial cell before the centre.

♂ Similar, smaller, the apical segment more blunt at apex.

Long. 4—4·5 *mm.*

HABITAT : Quetta ; Peshin ; fairly common.

This species belongs to the Lindenius group. In Bingham's key it would come next to *C. nanus*, from which it differs in sculpturing. It bears a strong resemblance, superficially, to a Prosopis.

CRABRO ELONGATUS, n. sp. (*Dudgeon MS*).

" ♀ Head, thorax, and abdomen smooth, the former opaque, the " latter shining ; an impressed line from base of antennæ to anterior " ocellus ; median segment convex, narrowed posteriorly, with some " longitudinal striæ at base, and a median longitudinal furrow ; " abdomen petiolate, first segment as long as the rest of the abdomen, " very narrow, with the apex rather abruptly nodose ; posterior tibiæ " dilated ; clypeus with silvery pile, cheeks obscurely pilose. Black ; " the scape of antennæ, anterior and intermediate tarsi, anterior tibiæ, " apex of the anterior femora, and a spot on each side of the pronotum " pale yellow.

" *Long.* 8-9 mm.

" HABITAT : Holta, Kangra Valley, 4,500ft.

" Nearest to *C. petiolatus* (Nurse), but larger, the petiole narrower " and the yellow markings as mentioned."

THE MOTHS OF INDIA.

SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

SERIES II. PART IX.

By Sir G. F. Hampson, Bart., F.Z.S., F.E.S.

(*Continued from page 659 of Vol. XIV.*)

Moths of India—5a.

Schœnobianæ.

Genus Goniopalpia, nov.

Proboscis absent; palpi with the 2nd joint porrect and extending about twice the length of head, the 3rd upturned and dilated at extremity; maxillary palpi filiform; antennæ laminate; tibiæ with the spurs long. Forewing with vein 3 from before angle of cell; 4·5 from angle; 6 from below upper angle; 7 from angle, straight; 8·9·10 stalked; 11 free; the termen somewhat excised from apex to middle. Hindwing with veins 3 and 5 from close to angle of cell; 6·7 from upper angle, 7 anastomosing with 8; the termen strongly excised from apex to middle and again towards tornus.

Goniopalpia delicatalis ♂ ♮

4240*a*. Goniopalpia delicatalis, n. sp.

♂. White; palpi with the 1st and 2nd joints black at sides and the 3rd joint near extremity; fore tibiæ blackish above, the tarsal joints ringed with black. Forewing with the base of costal area tinged with fulvous; traces of a curved antemedial line; a slight fuscous discoidal lunule; the veins beyond the cell streaked with fulvous yellow and the interspaces suffused with fuscous; a subterminal white line from costa to vein 2, incurved at lower extremity, slightly edged by black on inner side and strongly on outer side and with some fulvous yellow suffusion beyond it; the termen yellow with fine black line on its inner side; cilia white with fine blackish line through them and the tips blackish. Hindwing with the terminal half slightly tinged with fulvous yellow.

Habitat.—Khásis. *Exp.* 14 mill. *Type*—In Coll. Rothschild.

4254*a*. Patissa fulvidorsalis, n. sp.

♂. Palpi not extending beyond the frons; silvery white; legs tinged with golden fulvous on inner side; abdomen dorsally fulvous yellow except the 1st two and terminal segments.

Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 36 mill. *Type*—In B. M.

4269*a*. SCHŒNOBIUS AURIVENA, n. sp.

♂. White; palpi at sides and stripes on shoulders and legs orange. Forewing with the costa and interspaces streaked with orange; a subterminal orange line; a terminal series of orange red points; cilia orange.

Habitat.—Khásis. *Exp*. 22 mill. *Type*—In B. M.

ANERASTIANÆ.

Genus STATINA.

Statina, Rag. N. Am. Phyc. and Gall., p. 19 (1887).

Type—S. roseotinctella, Rag.

Range— N. and S. America; Kashmir; New Guinea.

Proboscis aborted, minute; palpi downcurved, extending about four times length of head; frons with tuft of hair; antennæ of male ciliated. Forewing with vein 2 from towards angle of cell; 3 and 5 on a long stalk. 4 absent; 6 from below upper angle; 8·9·10 stalked; 11 from angle. Hindwing with vein 2 from close to angle of cell; 3·4 absent; 6·7 from upper angle, 8 anastomosing strongly with 7.

4275*a*. STATINA CASHMIRALIS, n. sp.

♀. Head and thorax whitish, strongly tinged with red; abdomen dorsally ochreous. Forewing ochreous-white, suffused with rufous; the median nervure and base of veins 3·5, streaked with white. Hindwing semihyaline ochreous-white.

Habitat.—Kashmir, Dras (Leech). *Exp*. 22 mill. *Type*—In B. M.

4302*b*. SALURIA MINUTELLA, n. sp.

♂. Antennæ with short branches extending to near apex.

Head and thorax fuscous-grey; abdomen white, dorsally ochreous towards base. Forewing fuscous-grey; the costal area broadly whitish, extending to median nervure and vein 5 in and beyond end of cell; traces of an antemedial line and discal point. Hindwing white, slightly tinged with fuscous.

Habitat.—Deesa (Nurse); Ceylon (Pole.) *Exp*. 14 mill. *Type*—In B. M.

4314*a*. POLYOCHA TRICOLORALIS, n. n.

„ *variegatella*, Hmpsn., Journ., Bom. Nat. Hist. Soc., XII. p. 310, nec Rag.

Habitat.—Sikhim.

4314*a*. POLYOCHA VARIEGATELLA, Rag. Nouv. Gen., p. 39; *id*., Rom. Mem., VIII., pl. 36, f. 16.

♀. Head and thorax deep flesh-pink; pectus and legs paler, the fore tibiæ and tarsi streaked with white above; abdomen ochreous-white. Forewing with narrow white costal fascia, ending in a point, just before apex; the rest of wing deep flesh-pink, suffused with brown down to median nervure and vein 3; the veins with slight pale streaks. Hindwing semihyaline yellowish-white, tinged with fuscous towards costa.

Habitat.—Kangra Valley. *Exp*. 34 mill.

4315*a*. POLYOCHA PULVEREALIS, n. sp.

♂. Antennæ with long uniseriate branches; forewing with veins 4·5 and 10 from cell; hindwing with veins 3·4·5 stalked.

Head, thorax and abdomen pale grey-brown, mixed with black. Forewing pale grey-brown, irrorated with black, thickly on costal half, a diffused black discoidal spot; a terminal series of points. Hindwing pale, tinged with brownish, especially towards costa; a fine terminal line.

Habitat.—Khásis. *Exp.* 30 mill. *Type*—In B. M.

2315*b*. POLYOCHA ORNATELLA, n. sp.

♂. Antennæ of male with long uniseriate branches; forewing with veins 4·5, approximated for some distance; 10 from cell; hindwing with vein 3 from cell.

Head and thorax pale yellowish-brown; abdomen ochreous. Forewing with the costal area crimson, suffused with purplish-fuscous; a white subcostal stripe ending on costa at apex; the inner area yellow with antemedial and medial crimson bands and a broad terminal band slightly tinged with grey; cilia ochreous with two crimson lines through them, dark at apex. Hind wing fuscous; cilia yellow with a dark line through their bases towards apex.

Habitat.—Kangra Valley, 4500′ (Dudgeon). *Exp.* 26 mill. *Type*—In B. M.

PHYCITINÆ.

4320*a*. HOMŒOSOMA NIMBELLA, Zell Isis, 1839, p. 178.

„ *Saxicola*, Vaughan Month. Mag., VII., p. 132 (1870).

„ *Caniusella*, Rag. Rom. Mem., VIII., p. 248, pl. 33, f. 16 (1901).

Head and thorax white, irrorated with brown; abdomen white, obscurely banded with fuscous. Forewing whitish, tinged with brown and thickly irrorated with fuscous; the area from costa to median nervure whiter to the postmedial line; an indistinct dark subbasal spot on median nervure; a curved medial series of three spots on the veins; the two discoidal points large; a rather indistinct oblique postmedial line. Hindwing semihyaline white; the veins, a fine terminal line and a line at base of cilia brownish.

Habitat.—Europe; Canaries; W. Asia; Kashmir, Dras. *Exp.* 18-24 mill.

4324*b*. HOMŒOSOMA NIGRIMEDIALIS, n. sp.

♂. Pale reddish-brown; forewing with some black irroration on costal area; a prominent black streak on median nervure and bases of veins 2·3·4; a black streak on vein 1, most prominent on medial area; slight black streaks on veins of terminal area; the lines pale, the 1st line medial, sinuous, the 2nd oblique and slightly bent inward below costa; a terminal series of black striæ. Hindwing semihyaline white; the veins and costal area fuscous; a fuscous terminal line and line through the cilia.

Habitat.—Khásis. *Exp.* 22 mill. *Type*—In Coll. Rothschild.

4325*e*. ECCOPIDIA OINISTIS, n. sp.

♀. Head, thorax and abdomen grey, irrorated with fuscous; the anal tuft fulvous. Forewing grey, irrorated with fuscous; an indistinct curved medial line interrupted at median nervure; two discoidal points; the terminal area suffused with purple-red, forming a diffused darker band. Hindwing semihyaline, tinged with brown.

Habitat.—Ceylon, Kandy (Pole). *Exp.* 16 mill. *Type*—In B. M.

4325*f*. PSOROSA PROLEUCALIS, n. sp.

♂. Head and thorax ochreous; antennæ fuscous, the tuft of scales in sinus black; abdomen ochreous, dorsally tinged with fuscous. Forewing ochreous; the costal area broadly white to the 2nd line and slightly irrorated with red; the basal area suffused with fuscous to the antemedial line except on costal area and base of inner margin; the antemedial line represented by a red spot on subcostal nervure and black spots on white patches on median nervure and vein 1; the discoidal black points prominent, the lower large; the subterminal line white, rather punctiform, oblique from costa to vein 6, excurved at middle and slightly angled inwards on vein 1; defined on each side by an oblique black streak from apex, then by short black streak on the veins; some white on termen and a prominent series of black points; cilia brown with two white lines through them. Hindwing pale ochreous, the veins and costal area tinged with brown; a fine terminal line and line at base of cilia.

Habitat.—Simla (Nurse). *Exp*. 22 mill. *Type*—In B. M.

4325*g*. PSOROSA BIFILIFERALIS, n. sp.

♂. Antennæ with slight sinus at base of shaft with scale teeth in it.

Head and thorax white; antennæ brownish; tarsi banded with black; abdomen whitish, dorsally banded with black. Forewing pale brownish-ochreous, the costal half white, irrorated with brown, the costal edge blackish; an antemedial diffused black patch on vein 1; an indistinct medial line; discoidal points prominent, black, the lower largest; postmedial line whitish, defined by diffused black on each side; a terminal black patch with white patch on it, broad at costa, narrowing to a point at vein 1. Hindwing semihyaline white, tinged with fuscous towards termen; a fine dark line at base of cilia.

Habitat.—Sikhim, 2000′ (Pilcher). *Exp*. 16 mill. *Type*—In B. M.

4327*a*. HETEROGRAPHIS HELLENICA, Stgr. Hor. Ent. Ross, 1870, p. 209, pl. II, f. 18.

Head, thorax and abdomen white, tinged with ochreous above. Forewing bright yellow; the costa white, broad, rather diffused; oblique purplish-pink sub-basal and medial bands from subcostal nervure to inner margin; a postmedial band, with irregularly sinuous edges, bent outwards to costa, where it joins the terminal band which runs round the apex. Hindwing pale ochreous, the cilia white except at base.

Habitat.—Greece; Syria; Deesa. *Exp*. 16 mill.

4328*a*. HETEROGRAPHIS DESERTICOLA, Stgr. Stett. Ent. Zeit., 1870, p. 201; Rag. Rom. Mem., VIII., p. 148, pl. XXVIII., f. 17.

Head, thorax and abdomen white, tinged with pale yellow-brown above; the 3rd joint of palpi and frontal tuft blackish in the Indian, yellowish in the European, specimens. Forewing pale yellow-brown, with white costal fascia, narrowing to apex; slight traces of discoidal points; the termen blackish. Hindwing hyaline white, the veins, terminal area and base of cilia tinged with brown.

Habitat.—Armenia, Sarepta; Transcaucasia, Askabad; Punjab, Ferozpur. *Exp*. 14-20 Mill.

4328*b*. HETEROGRAPHIS NIVEICOSTELLA, Rag. Rom. Mem., VIII., p. 149, pl. XXXIX, f. 7.

♀. Pale reddish-brown. Forewing slightly irrorated with darker scales; a white costal fascia, irrorated with brown and narrowing to apex; traces of discoidal points. Hindwing semihyaline white, the terminal half and base of cilia tinged with brown.

Habitat.—Transcaucasia, Askabad; Deesa. *Exp.* 18 mill.

4329*a*. HETEROGRAPHIS MICROSTICTELLA, n. sp.

♂. Maxillary palpi flattened against the frons.

Ochreous-white, tinged with pale rufous; abdomen white. Forewing with white costal fascia irrorated with ochreous and narrowing to apex; traces of a sinuous white antemedial line, with a fuscous point on its outer side on vein 1; the discoidal points very obscure and pale rufous; an obscure sinuous whitish subterminal line, with slight dark shade on inner side. Hindwing semihyaline white, tinged with fuscous towards termen.

Habitat.—Deesa (Nurse). *Exp.* 20 mill. *Type*—In B. M.

4329*b*. HETEROGRAPHIS FULVIMARGINELLA, n. sp.

♀. Head, thorax and abdomen whitish, marked with patches of fulvous and black scales above. Forewing whitish, thickly suffused with fulvous and black scales, leaving a white costal fascia slightly irrorated with black and narrowing to apex; an oblique dentate whitish antemedial line; the subterminal line whitish, angled inwards in discal fold and with fulvous band on outer side; cilia whitish. Hindwing semihyaline white, the veins and termen tinged with brown.

Habitat.—Deesa (Nurse). *Exp.* 24 mill. *Type*—In B. M.

4331*a*. HETEROGRAPHIS OBSCURALIS, n. sp.

Head, thorax and abdomen brownish-grey, mixed with pale grey. Forewing pale grey and grey-brown; an indistinct pale almost medial line defined by grey, excurved from below costa to submedian fold where it is slightly angled inwards; two obscure dark discoidal points; a pale subterminal line, defined on each side by grey, slightly angled inwards at vein 6, then excurved to submedian fold, where it is again angled inwards; an obscure terminal series of dark points. Hindwing pale brownish-grey; cilia white at tips.

Habitat.—Ceylon, Hambantota, Matale (Pole). *Exp.* 16 mill. *Type*—In B. M.

4332*a*. HETEROGRAPHIS CRATICULELLA, Rag. Ann. Soc. Ent. Fr., 1887, p. 251.

Antennæ of male with slight sinus at base of shaft with scale teeth in it.

♀. Head and thorax ochreous-brown, mixed with white; abdomen white dorsally, tinged with ochreous. Forewing ochreous-brown; a broad white fascia just below costa from base to near the postmedial line; an oblique white antemedial band diffused on outer side; a wedge-shaped white fascia on median nervure from beyond the antemedial band, enclosing a short brown streak at lower angle of cell and expanding towards the oblique postmedial

line which expands on costa ; a white fascia on vein 1 between the ante- and postmedial lines ; an oblique white subterminal band not reaching costa towards which it expands, somewhat diffused on inner side ; all the white markings with some dark-brown scales on their edges. Hindwing semihyaline ochreous ; a fine terminal line ; cilia white with a fine line at base.

Habitat.—C. Asia, Marghilan ; Kashmir (Dras). *Exp.* 24 mill.

4341*b*. EUZOPHERODES IRRORALIS, n. sp.

Head and thorax pale brownish-ochreous ; abdomen ochreous-white. Forewing pale brownish-ochreous, irrorated with black and with black points on middle of median nervure and vein 1, at upper angle of cell and postmedial points just below costa, in discal fold and on vein 1 and a terminal series. Hindwing ochreous-white.

Habitat.—Ceylon, Hambantota, Puttalam (Pole). *Exp.* 10 mill. *Type*—In B. M.

4341*c*. EUZOPHERODES EPHESTIALIS, n. sp.

♀. Forewing with veins 3·5 from angle of cell ; 8· 9·10 stalked.

Head and thorax greyish-brown, mixed with black ; abdomen pale brown. Forewing grey-brown, irrorated with black ; the costal area black, irrorated with grey ; a black streak on base of inner margin ; a diffused black streak on vein 1 from before middle to the diffused medial black band ; discoidal points large, almost conjoined ; postmedial line strong, erect and angled outwards at middle ; an indistinct dentate subterminal line ; a terminal series of black points. Hindwing pale brown, with rather darker terminal line and line at base of cilia.

Habitat.—Sikhim, 7000′ (Pilcher). *Exp.* 22 mill. *Type*—In B. M.

4343*b*. EUZOPHERA ALBICOSTALIS, n. sp.

♂. Head, thorax and abdomen fuscous-brown, the head and thorax suffused with black. Forewing pale brown, thickly irrorated with fuscous ; the costal area white, tapering to a point before apex ; a whitish discoidal point and an indistinct series of dark points on termen. Hindwing pale brown, tinged with fuscous towards costa ; a fine dark terminal line and line at base of cilia.

Habitat.—Kashmir, Scind Valley (Leech). *Exp.* 26 mill. *Type*—In B. M.

4343*c*. EUZOPHERA CEDRELLA, n. sp.

Forewing with veins 4·5 and 10 from cell ; hindwing with veins 3·5 from cell.

Fuscous-brown, irrorated with grey and with a slight olive tinge. Forewing with rather narrow antemedial white band, dentate on outer side below costa and in submedian fold and bent outwards to inner margin ; a black discoidal lunule ; a more or less prominent minutely dentate white postmedial line, bent inwards below costa and outwards between veins 5 and 2 ; a terminal series of black points. Hindwing uniform golden-brown ; the cilia paler, with a brown line near base.

The larva destroys the cones of the Deodar Cedar.

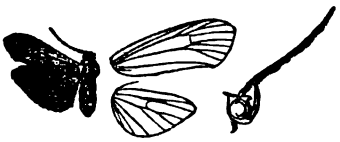
Habitat.—Simla (Pilcher) ; Punjab, Jaunsar. *Exp.* 22 mill.

Genus MESCINIA.

MESCINIA, Rag. Rom. Mem., VIII., p. 83 (1901).

Type—*M. commatella*, Zell., from Colombia.

Proboscis well developed ; palpi upturned, the 2nd joint reaching above vertex of head, the 3rd long ; antennæ ciliated. Forewing with veins 2·3 stalked, 4·5 from angle ; 6 from upper angle ; 8 and 10 stalked ; 9 absent ; 11 from cell. Hindwing with vein 2 from before angle of cell ; 3·5 stalked ; 4 absent ; 7 becoming coincident with 8.



Mescinia micans ♂ ½.

4346. MESCINIA MICANS.

4346*a*. MESCINIA OLIVESCALIS, n. sp.

♀. Very pale olive-brown ; palpi blackish towards tips ; abdomen dorsally suffused with fuscous. Forewing irrorated with fuscous ; an obscure dark discoidal spot. Hindwing hyaline, the veins and a terminal line brown.

Habitat.—Ceylon, Kandy. *Exp.* 12 mill. *Type*—In B. M.

Sect. II. Maxillary palpi of male, minute, triangularly scaled ; frons without tuft.

4348*a*. SANDRABATIS PHÆELLA, n. sp.

♂. Head, thorax and abdomen deep fuscous-brown ; palpi in front and anal tuft ochreous. Forewing deep fuscous-brown ; a black spot on vein 1 on traces of the antemedial line ; the two discoidal black points prominent ; the postmedial line very indistinct, angled inwards below costa, outwards on vein 5 ; traces of a dentate subterminal line ; a terminal series of black points. Hindwing of pale-brown with dark terminal line and line through the cilia which are yellowish.

Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 28 mill. *Type*—In B. M.

Genus BLABIOIDES, nov.

Palpi upturned to above vertex of head with a hollow containing the brush-like maxillary palpi ; antennæ of male with the basal joint dilated ; the shaft laminate with a large sinus and tuft at base. Forewing long and narrow ; veins 4·5 from a point ; 8·9·10 stalked. Hindwing with the cell about one-fourth of wing ; vein 2 from angle ; 3 approximated for some distance to 4·5 which are stalked ; 7 anastomosing strongly with 8.

4348*b*. BLABIOIDES STRIGERELLA, n. sp.

♂. Head and thorax bright rufous, slightly streaked with black ; maxillary palpi ochreous ; abdomen ochreous. Forewing bright rufous, the veins streaked with blackish ; a whitish streak above median nervure ; a pale curved subcostal streak from before middle to apex ; a pale streak from inner margin near base, oblique to vein 1 along which it runs to the subterminal line which

Blabioides strigerella ♂ ½

is oblique, angled inwards below apex and pale ; a fine dark terminal line. Hindwing pale brownish, with fine dark terminal and cilial lines.

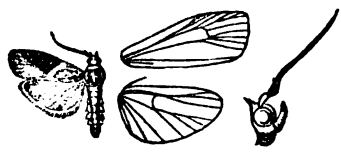
Habitat.—Ceylon, Nawalapittya. *Exp.* 20 mill. *Type*—In B. M.

Genus PTYOMAXIA, nov.

Type—*P. trigoniphora*, Hmpsn.

Range—Ceylon.

Palpi upturned, reaching just above vertex of head, the third joint well developed ; maxillary palpi small, dilated with scales, flattened against the frons ; antennæ of male laminate with large sinus and tuft at base. Forewing with costal fold ; veins 3·4·5 from angle of cell ; 8·9·10 stalked. Hindwing with the cell about one-third of wing ; vein 2 from angle ; 3·4·5 stalked ; 6·7 stalked ; 7 anastomosing with 8.



Ptyomaxia trigonifera ♂ ¾

4349*a*. PTYOMAXIA TRIGONIFERA, n. sp.

♂. Pale yellowish-brown ; antennæ with the tuft red-brown. Forewing with oblique diffused medial whitish line with large dark red-brown patch beyond it, its base on costa extending almost to apex, its apex on vein 1. Hindwing suffused with fuscous, the cilia pale.

Habitat.—Ceylon, Puttalam (J. Pole). *Exp.* 16 mill. *Type*—In B. M.

4351*a*. NEPHOPTERYX HYPOCAUTELLA, n. sp.

♂. Maxillary palpi flattened against the frons ; antennæ without sinus and tuft ; forewing with the cell on underside clothed with ferruginous red scales.

Head, thorax and abdomen clothed with white and grey-brown scales. Forewing irrorated brown and white ; a brownish-ochreous band just before middle with two tufts of vinous red scales on its inner side below the cell, with a fine white line on their inner side, a purplish spot on costa on outer edge of band ; traces of the discoidal points and of a sinuous subterminal line. Hindwing semihyaline white, the terminal half tinged with brown.

Habitat.—Deesa (Nurse). *Exp.* 14 mill. *Type*—In B. M.

4359*a*. NEPHOPTERYX RIVULELLA, Rag. Nov. Gen., p. 18 ; *id.*, Rom. Mem., VII., p. 294, pl. XLI., f. 14.

Head white ; thorax purplish-brown, mixed with white ; abdomen brown with segmental white lines. Forewing cupreous-brown with a purplish gloss ; some ochreous at base of inner margin ; the 1st line almost medial, fine sinuous and placed on a broad somewhat diffused white band ; the post-medial line very indistinct, white, sinuous. Hindwing semihyaline white, the costa and termen brown ; a brown line through the cilia.

Habitat.—W. Africa, Accra ; Deesa ; Ceylon ; Penang. *Exp.* 16 mill.

4359*b*. NEPHOPTERYX FUMOSELLA, Rag. Ann. Soc. Ent. Fr., 1887, p. 229 ; *id.*, Rom. Mem., VII., p. 246, pl. IX, f. 4.

Antennæ of male with slight sinus at base of shaft with scaly teeth in it. Head and thorax ochreous, strongly irrorated with fuscous-brown; abdomen ochreous, tinged with fuscous. Forewing ochreous-grey, strongly irrorated with fuscous-brown; the antimedial line indistinct, whitish, oblique from costa to median nervure, interrupted below cell and angled inwards on vein 1; two dark discoidal points; the subterminal line indistinct, whitish, inwardly oblique from costa to vein 5, minutely dentate on veins 5 to 2 and angled inwards in submedian fold; a terminal series of dark points. Hindwing semihyaline, tinged with pale-brown; a darker terminal line and fine line at base of cilia.

Habitat.—C. Asia, Samarkand; Kashmir, Goorais Valley. *Exp.* 30 mill.

4359*c*. NEPHOPTERYX MYRMIDONELLA, Rag. Rom. Mem., VIII., p. 103, pl. XLIV, f. 7.

Antennæ of male with a slight sinus at base of shaft with tuft of black scales in it, maxillary palpi flattened against the frons.

Head, thorax and abdomen grey-brown and white, the head and thorax irrorated with some black scales. Forewing grey-brown, with fine white streaks defining the subcostal and median nervures, the discal fold in cell and the veins beyond the medial line which have dark streaks on them; some black irroration, especially on basal half of inner area; a slightly sinuous medial yellow line defined by rough black scales, forming a large tuft on inner side below the cell; a black point at lower angle of cell. Hindwing, semihyaline white, with fine brownish terminal line, diffused inwards in female.

Habitat.—W. Africa, Old Calabar, Nigeria Borgu, E. Africa, Teita (Jackson); Deesa (Nurse); Ceylon, Puttalam (Pole). *Exp.* ♂ 14, ♀ 16 mill.

4408. PHYCITA HYEMALIS transfer to NEPHOPTERYX sect. *Palibothra* 4360*a* and re-name the species with uniseriate branches to antennæ PHYCITA MONOPECTEN. n.n.; the former occurs in Formosa, Simla, Sikhim, Ceylon and Sierra Leone, the latter in Ceylon.

4362*a*. NEPHOPTERYX (*Palibothra*) TUMIDELLA, n. sp.

Mid-femora of male with a tuft of long hair in a groove.

Head and thorax dark-brown, slightly mixed with grey; abdomen grey-brown. Forewing dark-brown, slightly irrorated with grey; the antemedial band with its inner part olive-yellow, its outer pure white and defined on each side by ridges of leaden scales; the discoidal points obliquely placed on a white patch which extends to costa and along it to the subterminal line which is white defined by dark-brown, its medial part excurved; a terminal series of black points. Hindwing semihyaline white, the veins and termen tinged with brown.

Habitat.—Ceylon, Puttalam (Pole). *Exp.* 16 mill. *Type*—In B. M.

4363*a*. NEPHOPTERYX (*Thylocoptila*) ATRISQUAMELLA, Hmpsn., Rom. Mem., VIII., p. 551, pl. 57, f. 19.

♂. Fore and hindwings with streaks of black scales below costa on underside. Head and thorax black, slightly mixed with pale-brown; abdomen grey

with black subdorsal patches, the ventral surface irrorated with black. Forewing black, irrorated with leaden grey scales; the inner and terminal areas obscurely tinged with brown; faint traces of a black medial line and discoidal series of points; a more distinct subterminal greyish line, defined on each side by black and excurved at middle; a terminal series of black points. Hindwing hyaline white, the termen tinged with brown.

♀. Rather browner.

Habitat.—Ceylon, Puttalam, Matale; Queensland, Cooktown. *Exp.* 24-26 mill.

4363*b*. NEPHOPTERYX ALBIFASCIALIS, n. sp.

♂. Legs and hindwing normal.

Head white and brown with some purple-red scales; the brush-like maxillary palpi fulvous; thorax and legs purplish black-brown with whitish patches on tibiæ; abdomen brownish-ochreous, tinged with dark-brown at base and extremity. Forewing black-brown; the inner and terminal areas mixed with grey and red-brown scales; a pure white slightly curved fascia from below costa near base to apex. Hindwing semihyaline ochreous-white, the costa and termen tinged with brown; cilia white, brown at base.

Habitat.—Ceylon, Matale (Pole). *Exp.* 20 mill. *Type*—In B. M.

4364*a*. NEPHOPTERYX STRIGINERVELLA, n. sp.

Palpi of male hollowed out to receive the brush-like maxillary palpi; antennæ with slight ridge of scales at base, ending in a projecting point, the shaft serrate and fasciculate.

♂. White, with an ochreous-brown tinge; antennæ with the shaft blackish; palpi with dark streaks; thorax with a few dark scales. Forewing irrorated with some red-brown scales; an oblique antemedial series of reddish and black streaks lengthening towards inner margin and with an obscure line beyond them; raised bosses of pale and black scales at and below lower angle of cell; the veins of outer area streaked with dark red and black. Hindwing yellowish semihyaline white.

Habitat.—Ceylon (J. Pole). *Exp.* 18 mill. *Type*—In B. M.

4370*a*. NEPHOPTERYX RUBRALIS, n. sp.

♂. With streaks of black scales on underside below basal half of costa of forewing and subcostal nervure of hindwing.

Head and thorax ochreous, strongly tinged with red-brown; abdomen ochreous. Forewing ochreous, tinged with red-brown, the inner and terminal areas irrorated with fuscous; the 1st line medial, whitish, diffused, enclosing a black point on vein 1 and with diffused dark scales on its edges; lower discoidal point prominent, black, the upper indistinct; the 2nd line subterminal, formed of small dentate white marks on blackish streaks on the veins; an indistinct terminal series of dark points. Hindwing yellowish-white.

♀. Head, thorax and forewing redder, the last with hardly a trace of the blackish markings.

Habitat.—Madras (Watson). *Exp.* 20 mill. *Type*—In B. M.

4370*b*. NEPHOPTERYX CALAMALIS, n. sp.

♂. With streaks of black scales on underside below basal half of costa of forewing and subcostal nervure of hindwing.

Head and thorax pale-ochreous, slightly irrorated with black ; abdomen ochreous. Forewing pale-ochreous, irrorated with black ; more thickly on inner and terminal areas ; the 1st line medial represented by a black point on median nervure and a black-defined whitish line from submedian fold to inner margin, angled inwards on vein 1 ; a prominent black point at lower angle of cell ; the subterminal line whitish, defined by black, angled inwards and interrupted in discal and submedian folds and minutely dentate on median nervules ; a distinct terminal series of black points. Hindwing semihyaline yellowish-white, with some fuscous suffusion on costal area ; a dark terminal line and line at base of cilia.

Habitat.—Ceylon, Puttalam (Pole). *Exp.* 20 mill. *Type*—In B. M.

4370*c*. NEPHOPTERYX ASBOLALIS, n. sp.

Forewing of male with patch of black scales at base of costa on underside, the anal tuft more or less black.

Head, thorax and abdomen ochreous ; palpi and fore and mid legs with patches of black ; mid and hind tibial spurs and tarsi black. Forewing ochreous, with more or less blackish suffusion on inner half and on terminal area ; the antemedial line whitish, oblique and indistinct from costa to median nervure, where there is a black point beyond it, angled inwards on vein 1, where there is a more or less developed black patch before it and black point with pale patch beyond it on its outer side ; two black discoidal points ; the subterminal line whitish defined by black, oblique from costa to vein 6 ; excurved at middle and angled inwards in submedian fold ; a terminal series of black points. Hindwing semihyaline yellowish-white, with some fuscous suffusion on costa and fine dark lines on termen and at base of cilia.

Ab. 1. Forewing with the ground color grey ; hindwing with streaks of black scales on base of costa and subcostal nervure on underside.

Habitat.—Sierra Leone (Clements) ; Simla (Pilcher) ; Deesa (Nurse) ; Belgaum (Watson) ; Bali (Doherty). *Exp.* 20 mill.

4383. MYELOIS PECTINICORNELLA. The larva bores in the pods of cocao in Ceylon and is very destructive.

4383*a*. MYELOIS EPHESTIALIS, n. sp.

Antennæ of male ciliated.

Head and thorax grey, mixed with fuscous ; tarsi with pale rings ; abdomen ochreous with fuscous dorsal bands. Forewing grey, thickly irrorated with fuscous ; an oblique antemedial black line, slightly angled outwards in submedian fold, defined by whitish on inner side and diffused on outer ; a more or less prominent dark discoidal lunule ; a pale subterminal line, defined by blackish on inner side and excurved at middle. Hindwing semihyaline, tinged with fuscous ; cilia of both wings white at base, fuscous at tips.

Habitat.—Simla (Pilcher) ; Sikhim (Dudgeon). *Exp.* 16 mill. *Type*—In B. M.

4384*a*. HYPSIPYLA PSARELLA, n. sp.

Head, thorax and abdomen grey, mixed with brown; abdomen with segmental white lines. Forewing grey, thickly irrorated with brown; an antemedial white line oblique from costa to below cell, where it is acutely angled, then angled inwards on vein 1; a dark discocellular lunule; a minutely dentate white subterminal line, slightly bent outwards at middle; a series of dark terminal points. Hindwing semihyaline white, the termen and costa tinged with fuscous.

Habitat.—Sikhim, 1800′ (Dudgeon); Puttalam, Ceylon (Pole). *Exp.* 26 mill. *Type*—In B. M.

4384*b*. HYPSIPYLA ELACHISTALIS, n. sp.

♂. Maxillary palpi dilated and flattened against frons which is conical and prominent.

Head and thorax grey, mixed with fuscous, the shoulders tinged with olive-yellow; abdomen grey. Forewing grey; the costal area tinged with olive-yellow; the basal area suffused with fuscous and vinous scales; a medial black line with an ochreous band on its inner side oblique from costa to discal fold, then erect; two fuscous and vinous discoidal points; the terminal area suffused with fuscous and vinous scales obliquely from apex to middle of inner margin; a pale subterminal line defined on each side by black and slightly bent outwards at vein 6; an ill-defined terminal series of black points. Hindwing white, tinged with fuscous; cilia of both wings with a dark line through them.

Habitat.—Ceylon, Hambantota (Pole). *Exp.* 16 mill. *Type*—In B. M.

4384*c*. HYPSIPYLA ROTUNDIPEX, n. sp. (Pl. C., f. 26.)

Antennæ of male laminate; forewing with the basal half of costa fringed with long hair, the apex rounded.

♂. Head and thorax black-brown; abdomen reddish-brown. Forewing black-brown, with rufous streaks below submedian fold and vein 1 and between veins of outer area. Hindwing semihyaline brown with a rufous tinge, the veins and fine terminal line and line through the cilia darker.

Habitat.—Sikhim, 2600′ (Pilcher). *Exp.* 36 mill. *Type*—In B. M.

4386*a*. PHYCITA HEMIPEXELLA, n. sp.

♂. Antennæ of male with large sinus and tuft; the basal half of shaft bipectinate with diminishing branches; maxillary palpi triangular, flattened against the frons.

Head, thorax and abdomen ochreous; thorax suffused with purplish-fuscous, except the front of tegulæ and shoulders; abdomen irrorated with purplish-fuscous. Forewing ochreous, the costal area and cell suffused with black, leaving an ochreous discoidal spot; a blackish antemedial patch below the cell; the postmedial line indistinct, angled beyond the cell, then very oblique and ending at vein 1; traces of a waved subterminal line; the inner area irrorated with purplish-red. Hindwing semihyaline whitish, the costal area tinged with fuscous; a fine brownish terminal line and a line through the cilia

Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 18 mill. *Type*—In B. M.

4386*b*. PHYCITA PHÆELLA, n. sp.

♂. Maxillary palpi flattened against the frons; antennæ with a large sinus and tuft at base.

Head and thorax dark-brown, tinged with grey and irrorated with a few blackish scales; abdomen brown. Forewing dark-brown, suffused with grey and irrorated with blackish scales; a slight medial dark streak on vein 1, a series of postmedial streaks and some dark points on termen. Hindwing hyaline white; the fringes of hair on median nervure and base of vein 1 brown; the termen and base of cilia brown.

Habitat.—Deesa (Nurse). *Exp.* 22 mill. *Type*—In B. M.

4393. PHYCITA STENIELLA.

♂. Maxillary palpi filiform; antennæ with the basal joint dilated and angled behind, the shaft with large sinus ending with a tuft of scales.

4403*a*. PHYCITA ERYTHROLOPHIA, n. sp.

Maxillary palpi of male brush-like in hollow of labial palpi; antennæ laminate, ciliated with large hollowed out tuft at base of shaft; mid-tibiæ with fold containing a tuft of vinous hair; claspers and anal tuft very large, the latter tinged with vinous; hindwing with the base streaked with vinous scales on underside, a small hyaline streak above base of vein 2.

♂. Grey, tinged with brown; head blackish. Forewing irrorated with brown; an oblique antemedial ridge of large black scales across cell and submedian interspace; a medial whitish line, slightly defined by brown, oblique from costa to below cell where it is angled; the discoidal points black and obliquely placed; the subterminal line white, defined by brown, dentate, angled outwards on vein 6; a terminal series of black points. Hindwing semihyaline, the veins and margins brownish.

♀. Head not blackish.

Habitat.—Ceylon, Matale (Pole). *Exp.* ♂ 24, ♀ 20 mill. *Type*—In B. M.

4407*a*. PHYCITA ARDENTIA, n. sp.

♂. Head and thorax dark-rufous; abdomen pale yellow-brown. Forewing purplish red-brown; a pinkish white medial line angled inwards on vein 1 and with some purplish grey on its outer edge; a dark discoidal lunule; a whitish subterminal line obtusely angled on vein 5; a fine dark terminal line. Hindwing whitish semihyaline, the apical area tinged with fuscous; a fine dark terminal line and line through the cilia.

Habitat.—Sikhim, 7000′ (Pilcher). *Exp.* 20 mill. *Type*—In B. M.

4407*b*. PHYCITA OCHRALIS, n. sp.

Antennæ of male with slight sinus at base of shaft with black scale teeth in it.

♂. Head, thorax and abdomen ochreous; palpi and legs irrorated with fuscous. Forewing ochreous; the costal edge black, the costal area suffused with black and white scales towards apex; a diffused patch of rufous and black scales on inner area before middle; the cilia fuscous and white.

Hindwing semihyaline tinged with fuscous, especially on costal area; cilia white with fuscous line at base.

Habitat.—Kashmir, Goorais Valley (Leech). *Exp.* 22 mill. *Type*—In B. M.

4427*a*. CRYPTOBLABES EPHESTIALIS, n. sp.

♀. Head and thorax dark-brown; pectus, legs and abdomen grey-brown. Forewing dark-brown, the inner half suffused with red-brown; the lines represented by a few silvery grey scales. Hindwing hyaline, the veins and margins brown.

Habitat.—Ceylon, Matale (Pole). *Exp.* 14-16 mill. *Type*—In B. M.

Genus EPISCHNIA.

Epischnia. Zell. Isis 1839, p. 178.

Type—E. prodromella, Hübn.

Range—N. America; Europe; S. Africa; Madagascar; W. C. and N. Asia to Kashmir.

Proboscis fully developed; palpi thickly scaled, the 2nd joint oblique, the 3rd porrect; maxillary palpi dilated with hair; frons with tuft of hair; antennæ of male laminate with sinus at base of shaft, ending in some scale teeth and a slight tuft of hair; a large tuft of hair and large scales below shoulders. Forewing with veins 3·4·5 well separated; 6 from below upper angle; 8·9 stalked; 10·11 from cell. Hindwing with vein 3 approximated to 4·5, for nearly half their length; 6·7 stalked; 8 free.

4433*a*. EPISCHNIA CRETACIELLA, Mann. Ver. Zool. Bot. Wien 1869, p. 380; Rag. Rom. Mem., VII., p. 504, pl. XX., f. 1.

Head, thorax and abdomen white, tinged with pale-brown and irrorated with fuscous. Forewing white, irrorated with black and the interspaces tinged with pale-brown, the veins with streaks of black scales, defined on each side by white, the antemedial line represented by a slight oblique striga from costa and a slight striga on vein 1; a black point at lower angle of cell; traces of a postmedial line oblique from costa near apex to submedian fold where it is angled inwards; a subterminal series of short diffused streaks. Hindwing semihyaline whitish; the veins brown; the costal and terminal areas suffused with brown, especially in female; a fine terminal line and a line at base of cilia.

Habitat.—E. Europe; W. Asia; Kashmir (Dras). *Exp.* 28-30 mill.

Genus SELAGIA.

Selagia.—Hübn. Verz., p. 37 (1827).

Type—S. argyrella, Schiff.

Range— N. America; Europe; N. and Central Asia to Kashmir; Japan.

Proboscis fully developed; palpi thickly scaled, extending about the length of head, the 2nd joint oblique, the 3rd porrect; maxillary palpi somewhat dilated with scales; frons rounded; antennæ of male laminate, the shaft with sinus and tuft at base. Forewing with vein 3 from near angle of cell;

4·5 approximated for some distance ; 6 from below upper angle ; 8·9 stalked ; 10·11 from cell. Hindwing with the lower angle of cell produced, vein 3 from angle, 4·5 stalked ; 6·7 stalked ; 8 free.

4433*b*. SELAGIA SPADICELLA—Hübn. Eur. Schmett Tin., p. 31, f. 225 (1827) ; Rag. Rom. Mem., VII., p. 472.

Tinea janthinella—Hübn. Eur. Schmett Tin., ff. 374-375 (1827).

Nephopteryx saltuella—Mann. Wien. Mon. 1862, p. 392.

Head and thorax rufous, mixed with fuscous and grey ; legs fuscous and grey ; abdomen ochreous. Forewing rufous, the costal area and veins with diffused fuscous and grey streaks ; the antemedial line represented by slight dark streaks on the veins, or greyish, oblique from costa to median nervure and angled inwards on vein 1 ; discoidal points obscure ; the postmedial line obsolete or greyish, oblique, and angled inwards in submedian fold. Hindwing semihyaline ochreous ; the costal area suffused with fuscous ; a fine terminal line and a line at base of cilia.

Habitat.—Europe ; C. Asia ; Kashmir, Goorais Valley. *Exp.* 30 mill.

4434*a*. ETIELLA GRISEA, n. sp.

♂. Head and thorax grey ; maxillary palpi ochreous ; abdomen whitish. Forewing pale grey, irrorated with fuscous ; three obliquely placed antemedial bosses of leaden-coloured scales below the cell, with obscure yellow band beyond them, followed by dark points on median nervure and vein 1 ; two dark discoidal points and a diffused patch below end of cell ; traces of a subterminal line excurved at middle ; a fine terminal line. Hindwing yellowish semihyaline white with pale brownish terminal line.

♀. With ill-defined white subcostal fascia to forewing.

Habitat.—Ceylon, Puttalam (J. Pole). *Exp.* 18-24 mill. *Type*—In B. M.

4434*b*. ETIELLA MYOSTICTA, n. sp.

♂. Maxillary palpi filiform, slightly dilated at extremity.

Head and thorax ochreous, tinged with rufous ; abdomen ochreous. Forewing ochreous, tinged with rufous, sparsely irrorated with fuscous ; a fine whitish streak on median nervure ; the costal area greyish, slightly defined with fuscous below ; a black point at lower angle of cell ; a curved postmedial series of slight blackish streaks on the veins ; a terminal series of black points. Hindwing semihyaline ochreous, tinged with brown towards costa and termen ; a fine terminal line and a line at base of cilia.

Habitat.—Simla (Pilcher). *Exp.* 22 mill. *Type.*—In B. M.

4434*c*. ETIELLA UNIFORMALIS, n. sp.

♂. Head and thorax ochreous, tinged with rufous and mixed with fuscous ; abdomen ochreous. Forewing ochreous-grey, thickly irrorated and suffused with fuscous-brown ; a more ochreous streak in submedian fold. Hindwing ochreous-grey, tinged with fuscous-brown.

Habitat.—Kashmir, Goorais Valley (Leech). *Exp.* 28 mill.—*Type*—In B. M.

EPIPASCHIANÆ.

Genus ODONTOPASCHIA, nov.

Palpi obliquely upturned, the 3rd joint porrect; maxillary palpi strongly dilated with scales; antennæ of male with tufts of scales at extremity of basal joint; the shaft laminate, excised at base. Forewing with vein 3 from close to angle of cell; 4·5 stalked; 7·8 stalked, 9 absent; 10 from cell; a large tooth of scales on middle of inner margin; tufts of large erect scales at middle of cell and on discocellulars, bearing a few long thick hairs. Hindwing with vein 3 from close to angle of cell; 4 absent; 7 anastomosing with 8.

Odontopaschia virescens ♂ ½.

4435*a*. ODONTOPASCHIA VIRESCENS, n. sp.

Head and thorax brown; abdomen fuscous and grey. Forewing with the inner half brown, the costal half white, irrorated with green and with a large medial patch of dark-green; the antemedial line defined by fuscous, oblique, curved above inner margin and with a patch of diffused black scales before it on inner area; the tufts of scales in cell black and brown; some blackish scales below end of cell; the postmedial line dark, bent outwards at vein 5, dentate to vein 2, then excurved; a terminal series of black points. Hindwing fuscous-brown.

Habitat.—Khásis. *Exp*. ♂ 22, ♀ 26 mill. *Type*—In B. M.

4438*c*. MACELLA RUFIBARBALIS, n. sp. (Pl. C., f. 31.)

Maxillary palpi of male free, strongly tufted with hair; palpi with the 2nd joint very long; a very large tuft of hair on inner side of 2nd and 3rd joints; antennæ ciliated, the basal joint dilated; tufts of scales behind antennæ; hindwing with long fringes of hair on inner margin.

♂. Head, thorax and abdomen clothed with olive-green, white, pinkish and fuscous scales; palpi whitish, dark towards extremity; the tufts on inner side of 2nd joint red; abdomen with some black dorsal marks, the extremity brown and black. Forewing clothed with whitish and green scales, irrorated with black; a blackish mark at base of inner margin; an obliquely curved antemedial black band from cell to inner margin, with some brownish suffusion on its inner side; a tuft of brown scales in end of cell with dark mark on costa above it; the black postmedial line oblique from costa to vein 3, then strongly incurved and dentate; the apical area rufous; a terminal series of black spots. Hindwing fuscous, pale towards base; a pale subterminal mark on vein 2; the fringes of hair on inner area red. Underside with the apical area of forewing and whole of hindwing clothed with pale-brown scales.

♀. Much more green and fuscous with hardly any white scales; the thorax, base and apical areas of forewing especially green; underside purplish-

fuscous with pale patches towards base of wings; the discoidal lunules distinct.

Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 30 mill. *Type*—In B. M.

4442*a*. MACALLA PLICATALIS, n. sp.

♂. Palpi with the 2nd joint short, the 3rd very long and hollowed out to contain the brush-like maxillary palpi; antennæ ciliated with no tuft of scales behind them. Hindwing with the inner area dilated, forming a large fold containing rough fulvous scales on underside.

Head and thorax pale olive-brown; abdomen with the basal half yellow on dorsum, the terminal half and ventral surface ochreous, irrorated with fuscous. Forewing pale olive-brown with a thinly scaled patch on disk; some black scales on costa before middle and small tufts at middle and end of cell; an indistinct diffused dentate black line curved from costa to vein 2, then retracted to below end of cell; cilia pinkish with a series of black points. Hindwing semihyaline white; the terminal area tinged with fuscous; the inner area ochreous; cilia pinkish with a series of black points.

Habitat.—Ceylon, Matale (J. Pole). *Exp.* 32 mill. *Type*—In B. M.

4446*a*. MACALLA METASARCIA, n. sp. (Pl. C., f. 32.)

♀. Head and thorax ochreous, mixed with black; abdomen pinkish-ochreous, banded with black. Forewing pinkish-ochreous, almost entirely suffused with olive-black; prominent tufts of raised scales at middle and end of cell; an indistinct pale antemedial line; a postmedial line, highly excurved at middle, defined on inner sides by a black line, with a diffused pinkish-ochreous area on its inner side; a terminal series of black points; cilia pinkish with a black line through them. Hindwing flesh-color; a curved black postmedial line obsolescent towards costa and inner margin and with black spot on vein 2; a terminal band, wide at apex, tapering to a point at anal angle; cilia with a fuscous line through them.

Habitat.—Sikhim, 1800′ (Dudgeon). *Exp.* 22 mill. *Type.*—In B. M.

4449. MACALLA MARGARITA.

♂. Palpi with the extremity of 2nd and the 3rd joint fringed with long scales, the 3rd joint curved forward into a hook; maxillary palpi triangular and flattened against the frons; vertex of head hollowed out between antennæ, with tufts of scales from above eyes meeting over vertex; antennæ with long cilia for half their length, then with short cilia.

Habitat.—Ceylon, Hambantota (J. Pole).

4453*a*. CÆNODOMUS FUMOSALIS, n. sp. (Pl. C., f. 30.)

Dull olive-brown and fuscous. Forewing with obscure antemedial, medial and postmedial dark bands; a streak of black and white hair in submedian fold, another streak from middle of cell to near termen and a shorter streak above vein 6, the postmedial line excurved at middle. Hindwing with medial ridge of black and white hair and streaks in the interspaces towards apex; an obscure pale postmedial line excurved and dentate at middle.

Habitat.—Khásis. *Exp.* ♂ 32, ♀ 40 mill. *Types*—In Coll. Rothschild and B. M.

4464*a*. STERICTA RUBRESCENS, n. sp.

♂. Head, thorax and abdomen olive-green, the last with segmental black lines. Forewing olive-green with black patches at base below the cell and on inner margin ; a tuft of black hair in middle of cell ; a medial line oblique from costa to submedian fold, where it is slightly angled ; the postmedial line oblique from costa to just below vein 3, then strongly incurved ; some pink suffusion beyond it and a large patch in submedian interspace towards tornus. Hindwing suffused with pink ; some black suffusion at base and a patch below end of cell ; the postmedial line indistinct, oblique from costa to vein 3, where it is angled ; traces of a curved subterminal line.

Habitat.—Sikhim, 7000′ (Pilcher). *Exp*. 22 mill. *Type*—In B. M.

4464*b*. STERICTA SUSPENSALIS, Wlk. Cat. XXXIV, p. 1217.

♂. Head and thorax olive ; abdomen whitish, tinged with olive ; the basal segments with some black dorsal suffusion. Forewing whitish, the costal and antemedial areas tinged with olive ; a blackish patch at base of inner area ; traces of an antemedial white line ; a prominent postmedial slightly curved white line, slightly angled inwards above inner margin, the area beyond it fuscous ; the ridges of raised scales black and white. Hindwing whitish, tinged with olive before and beyond the curved postmedial line which is white defined by black on inner side towards inner margin and with black point below costa and three short streaks beyond its medial part.

In one specimen the whole hindwing is blackish to the postmedial line, and a large patch replaces the streaks beyond it.

Habitat.—Khásis ; Ceylon ; Borneo ; Bali. *Exp*. 20 mill.

4464*c*. STERICTA OLIVIALIS, n. sp.

Antennæ of male with the basal joint dilated, but without process ; maxillary palpi brush-like in fold of labial palpi.

♂. Head and thorax white and olive-green ; abdomen white and olive-green with dark dorsal bands. Forewing white, thickly irrorated with olive-green ; the costa with olive-green patches at base and middle ; obliquely placed subbasal blackish spots below cell and on inner margin ; an antemedial blackish line from cell to inner margin, interrupted at vein 1 ; a similar medial line angled outwards below cell, then inwards to near antemedial line ; a black spot at upper angle of cell and short streaks above bases of veins 3, 4 ; the postmedial line dentate, oblique from costa to vein 4 and incurved in submedian interspace, defined by white on outer side, followed by a large apical olive patch and another towards tornus ; a terminal series of small black spots. Hindwing whitish, tinged with brown ; the terminal area fuscous ; a dark terminal line and line at base of cilia.

Habitat.—Bhután (Dudgeon) ; Khásis. *Exp*. 30 mill. *Type*—In B. M.

4474*a*. ORTHAGA MIXTALIS, Wlk. Cat. XXVII, p. 104 (1863).

Forewing of male without glandular swelling on costa ; maxillary palpi dilated with scales and flattened against the frons ; antennæ with the basal joint dilated.

Head and thorax clothed with golden-green and white scales ; abdomen white and fuscous, tinged with brown towards extremity. Forewing white, irrorated and the basal area suffused with golden-green ; a more or less developed antemedial patch of black suffusion on median nervure, sometimes extending to costa and inner margin ; a curved medial black line from cell to inner margin ; a discoidal tuft of black scales ; the terminal third of wing suffused with golden-green and more or less with black, from vein 6 to inner margin extending as a broad band to inner side of postmedial line which is dentate, oblique from costa to vein 4, then somewhat inwardly oblique and angled inwards in submedian fold, defined by white on outer side ; a terminal series of black striæ. Hindwing pale fuscous-brown, with fine dark terminal line and line at base of cilia.

Habitat.—Bhután ; Borneo, Sarawak ; Java. *Exp.* 26 mill.

ON TWO CETACEANS FROM TRAVANCORE,

By H. S. Ferguson.

WITH A NOTE ON THE SAME,

By R. Lydekker, B.A., F.R.S., F.G.S., &c.

(*With plates A & B.*)

(*Read before the Bombay Natural History Society on 5th February* 1903.)

On the 14th of February, 1901, word was brought to me that a whale had been stranded on the beach in the neighbourhood of Trivandrum. I at once sent Mr. Shankara Narayana Pillay, the head taxidermist of the Museum, with men to secure the animal and make the necessary arrangements for skinning it and obtaining its skeleton. He made the following measurements and notes on the spot:—

Length, taken in a straight line from tip of snout to the bottom of the notch in the flukes ...	16ft. 10in.
Greatest circumference	7ft. 1in.
Do. do. at genital...	6ft. 5½in.
Do. do. at anus	5ft. 6in.
Caudal fin from tip to tip	3ft. 7½in.
Dorsal fin (falcate)	2ft. 2in.
Do. vertical height...	1ft. 4in.
Flippers (falcate)	2ft. 1in.

Blow-hole on the top of the head situated a little to the left of the middle line 21 inches from the tip of the snout. Head not distinct from neck. Beak not distinct, colour smooth glistening black throughout. After skinning it, he made the following notes on the internal organs:—

Heart from root of aorta to apex	1ft. 4in.
Do. circumference	2ft. 5in.

Liver lobe (*a*) 2ft. 2in., (*b*) 2ft. 1in.

Kidneys, right 1ft. 6in., left 1ft. 2in.

Stomach resembling a wide sack 32in. long and 15in. broad.

Intestines 109ft. 4in. long.

The stomach contained two fish, one 4ft. 1in., the other 1ft. 6in. long, in a half-digested state.

To enable the skin to be set up and at the same time to retain the skeleton complete, a cast of the skull was taken and was utilised in set-

Scale 1 to $\frac{5}{16}$.

12" 9" 6" 3" 0 1′ 2′ 3′ 4′ 5′ 6′ 7′ 8′ 9′ 10′ 11′ 12′ 13′ 14′ 15′ 16

C.S. del.

PSEUDORCA CRASSIDENS.

Mintern Bros. lith. London.

ting up the skin instead of using the skull. Subsequent examination of the skeleton brought out the following points :—

Vertebral column.—Cervical vertebræ 7. Dorsal 10. Lumbar 10. Caudal 20.—Total 47. The first four cervicals fused together. Epiphyses fused with the centra.

Ribs 10. Sternal 6. Costal 4. All ossified, the first 6 ribs two-headed.

The sternum composed of an ossified presternum and two mesosterna, with a cartilaginous xiphisternum.

The scapula fan-shaped with the external surface concave.

Phalanges I 1, II 2, III 5, IV 7, V 1.

Skull length 1ft. 10in., breadth between the orbits 1ft. 2in.

Teeth $\frac{0}{11}$ stout, 2in. in length and from ½ to ¾in. in diameter.

Ramis of mandible 2 1in., symphysis 3⅜in.

Pterygoids divergent posteriorly.

The anterior portion of the premaxilla broader than that of the maxilla.

Length of rostrum taken from an imaginary line joining the angles of the mouth 1ft. 2in.

From the size of the teeth it is evident that the animal is a "Killer" or "Grampus." The only genus mentioned by Blanford is *Orca* and the only species *O. gladiator*. It differs from this in colour, in having the dorsal fin of moderate size and falcate, the pectoral fins also of moderate size and falcate. in the number of vertebræ, and the number of ribs. It approaches more nearly to the genus *Pseudorca*, a meagre description of which is given by Beddard in his Book of Whales, but differs in the number of vertebræ (not an important point however) and in the divergence of the pterygoids.

Curiously enough on the same day the fishermen brought me another cetacean, which they had that morning caught in their nets. Its description is as follows :—

Colour uniform shining black, passing gradually into a fleshy plumbeous tinge on the sides and under surface. Pectoral, dorsal and caudal fins present. Beak distinct. Lower jaw slightly longer than the upper.

Length from tip of snout to notch in centre of

		caudal fin ...	8ft.	1in.
Do.	do.	to origin of pectoral fin ...	1ft.	1in.
Do.	do.	to origin of dorsal fin ...	3ft.	8in.

Length of pectoral fin which is falcate	...	...	1ft.	3½in.
Do. dorsal fin which is falcate...	...	...	1ft.	5in.
Height of dorsal fin ...	...	...	...	...	0ft.	8in.
Width of gape	...	...	...	...	...	1ft.	1in.
Greatest height	...	...	...	...	...	1ft.	6½in.
Do. circumference	...	...	...	...	4ft.	1in.
Smallest circumference at root of tail	...	...	0ft.	11in.

A single nasal aperture or blow hole on the top of the head. A prenaria adipose elevation marked off by a V-shape groove.

Vertebræ column.—Cervical 7, all fused together. Dorsal 13. Lumbar 17. Caudal 24.—Total 61. Epiphyses distinct. Vertebræ centra rather short. Sternum composed of presternum and two mesosterna ossified, with a cartilaginous xiphisternum.

Ribs 13. Costal 7. Sternal 6, all ossified. The first four ribs two-headed.

Phalanges I 1, II 6, III 8, IV 1, V 1. II and III well developed.

Skull.—Rostrum from anterior of the prenarial projection 4½in.

Mandible 17¾in., symphysis barely 2in.

Teeth moderate $\frac{2}{2}\frac{5}{5}$ and $\frac{2}{2}\frac{6}{5}$=51. Length of skull 20in.

Breadth 8½in. between orbits. Pterygoids not meeting in the middle line, borders divergent posteriorly.

This is a slightly immature specimen. According to Blanford's synopsis of the Indian Genera, it can only belong to the genus *Tursiops*, but it differs from the genus in having the pterygoids separate, and it differs in many respects from the only species *Tursiops tursio* described by him.

NOTES ON THE TRIVANDRUM CETACEANS,

By R. Lydekker, B.A., F.R.S., F.G.S., &c.

The first of the two specimens referred to by Mr. Ferguson (Pl. A) is undoubtedly referable to the genus *Pseudorca*, and presents no characters by which it can be distinguished from the widely distributed False Killer (*P. crassidens*). As that species, which is new to the Indian Fauna, never appears to have been properly figured, I have thought it well to reproduce the excellent sketch sent by Mr. Ferguson. I do not attach any importance to the difference with regard to the divergence of the pterygoid bones, nor in the number of vertebræ (47 instead of 50).

Scale 1′ to $\frac{5}{8}$″.

12″ 9″ 6″ 3″ 0 1′ 2′ 3′ 4′ 5′ 6′ 7′ 8′

C.S. del.

TURSIOPS FERGUSONI.

Mintern Bros. lith. London.

With regard to the second specimen (Pl. B), I agree with Mr. Ferguson in assigning it to the genus *Tursiops*, in spite of the fact that it differs from all the other species in the separation of the pterygoid bones of the skull. Externally it agrees with *Tursiops* in the form of the beak and fins, as well as in the general outline of the body, and the number and characters of the teeth. The number of vertebræ (61) is also that of *Tursiops* (61—64), and of no other of the allied genera.

Of the four species of *Tursiops* recognised by Mr. True,* the typical *T. tursio*, in addition to the united pterygoids, differs by the colour of the under-parts, which is either pale-grey or white, and the smaller number of teeth ($\frac{23}{22}$), the number of vertebræ being 64. The smaller *T. parvimanus*, of the Adriatic, in which the teeth number $\frac{25}{24}$ and the vertebræ 62, has also greyish-white under-parts. In the Australian *T. catalania* the under-parts are likewise white. On the other hand, *Tursiops abusalam* of the Red Sea comes nearer to the Trivandrum dolphin, having $\frac{26}{26}$ teeth and 61 vertebræ, and showing flesh-coloured markings mixed with green on the under-parts. The dark sea-green of the upper-parts does not, however, accord with Mr. Ferguson's description; and there is the aforesaid difference in the pterygoids. The Pacific *T. gilli* is too imperfectly known to admit of comparison.

On the whole, I think it advisable to regard the Trivandrum dolphin as a new species of *Tursiops*, allied to *T. abusalam* (of which I have no specimens for comparison), but distinguished by the divided pterygoids, the blacker colour of the upper-parts and the more decided plumbeous flesh-colour of the under-surface, which is marked with streaks instead of spots. It may be appropriately named *T. fergusoni*.

Mr. Ferguson has promised to present the skull to the British Museum. When it arrives, I might publish a notice of its characters.

* Bull. U. S. Mus., No. 36, p. 158 (1889).

A LIST OF THE BUTTERFLIES OF THE KONKAN.

By E. H. Aitken and E. Comber.

Since the first and second volumes of the Society's journal were published no attempt has been made to compile a list of our Bombay Butterflies and the references to local species in the later volumes have been few and far between. As there must be, in one way or another, a considerable number of our members who collect, or have collected, butterflies in the neighbourhood of Bombay in a more or less serious fashion, and who would be greatly assisted in their work if such a list were available for reference, we have gathered together the names, with a few short notes, of all those species that we have either personal knowledge of, or reliable information about, as occurring in the district.

One difficulty that confronted us was that of deciding as to what the limits of the local district should be, but, rejecting the idea of confining the list to those species that have been found on Bombay island itself on the ground that so large a portion of its area is now-a-days no longer suitable for the production and support of insect life, we decided to include the whole of the Konkan in the area dealt with, as being in itself a definite and characteristic district and as including most of the localities where those who attempt a collection are likely to find themselves in the field with net and killing bottle.

Taking the description of the district given by the late Mr. W. F. Sinclair in his papers on "The Waters of Western India," the Konkan may, roughly speaking, be defined as follows :—"Between the 16th and 21st degrees of North latitude (*i.e.*, from Vingorla to Surat) and between the watershed of the Sahyadri range (Western Ghats), with an average elevation of about 3,000 feet (rising in places to 4,500 ft.), and the coast." Any species found within this district may not unnaturally be expected to occur at any other *suitable* locality within its boundaries.

The list compiled by Mr. E. H. Aitken and published in the first and second volumes of our journal was based on the specimens then in the Society's collection from all parts of the Bombay Presidency with the exception of Sind and Canara. This list, besides being necessarily very incomplete, is not in the hands of many of our present local members, and is of course now largely out of date so far as the names attached to the species are concerned, owing to the constant changes

that have been made since its publication, as species, previously described under new names, have been found to be only local or geographical varieties of others and as the present practice of priority in nomenclature has been carried to an extreme.

For the *Nymphalidæ* and *Lycænidæ* we have followed Marshall and de Nicèville's book and we give their reference numbers in brackets for each species. In the absence of any up-to-date list of the *Pierinæ* and *Papilioninæ* we have adopted the arrangement and nomenclature of Messrs. Bell, Davidson and Aitken's paper on the Butterflies of North Canara, which appeared in Vols. X. and XI. of our journal, in conjunction with Capt. Watson's paper in Vol. VIII. of our journal on certain genera of *Pierinæ*. In the case of the *Hesperiidæ* we follow Capt. Watson's paper in Vol. IX. of our journal.

The number of species in our list only totals 130, and there are undoubtedly many more that can be added to it, but perhaps, with the present as a basis, others will be encouraged to add their experiences by communicating to the Society additions, which have not come our way.

FAMILY—NYMPHALIDÆ.

Sub-Family—Danainæ.

1 (16). *Danais aglea* (Cramer) [= *D. grammica* (Boisduval) in Marshall and de Nicèville].

Common at Matheran and on the hills after the rains, but not usually found below the Ghats. It has however been taken in Salsette.

2 (26). *Do.* *limniace* (Cramer). Common everywhere.

3 (28). *Do.* *chrysippus* (Linnæus). Common everywhere.

The variety or "sport," which wants the black on the apex of the forewing and has been named *D. klugii*, occurs occasionally throughout the district.

4 (31). *Do.* *genutia* (Cramer). Common everywhere.

5 (47). *Euplœa kollari* (Felder) [= *E. sinhala* (Moore) in Marshall and de Nicèville].

We took a specimen of this at Pali Hill, Salsette, in July last year. Probably fairly common throughout the district but often overlooked.

6 (61). *Do.* *core* (Cramer). Common everywhere.

7 (75). *Euplœa coreta* (Godart) [= *E. coreoides* (Moore) in Marshall and de Nicèville]. Dr. Smith includes this species in his list of Matheran butterflies, and it may be found to occur in the district.

SUB-FAMILY—SATYRINÆ.

8 (97). *Mycalesis mineus* (Linnæus). Common everywhere. The dry season form replaces the other about November.

9 (99). *Do.* *perseus* (Fabr:). Mr. J. A. Betham included this species in his list of Matheran Species in Vol. VIII of the Society's journal.

10 (135). *Lethe europa* (Fabr:). This species may probably be found anywhere on the hills. Mr. J. Davidson records it in the Society's journal (Vol. VIII., p. 556) at Matheran.

11 (140). *Do.* *neelgherriensis* (Guérin). Common on the hills before the rains, but not confined to them. It has been taken in the neighbourhood of Bombay.

12 (204).* *Ypthima philomela* (Johanssen). This species is probably often passed over, being mistaken for the next as they are indistinguishable in flight. The only definite records we have are from Andheri in Salsette and by Mr. J. A. Betham from Matheran.

13 (217). *Do.* *huebneri* (Kirby). Common everywhere.

14 (243). *Melanitis leda* (Linnæus). This species and its rain-season form *M. ismene* (Cramer) is common everywhere. Just after the rains in certain years they invade the whole town of Bombay in swarms and are to be seen in almost every room in the Fort.

SUB-FAMILY—ACRÆINÆ.

15 (298). *Telchinia violæ*. This is apparently not a common species everywhere; but it no doubt occurs throughout the district, and it becomes very common in some places about March.

* Specimens marked with an asterisk will be acceptable if sent to the Bombay Natural History Society's museum.

SUB-FAMILY—NYMPHALINÆ.

16 (300). *Ergolis taprobana* (Westwood). In Marshall and de Nicèville, Major Yerbury is quoted as having taken this at Khandala. As a matter of fact it is very common there and at Matheran after the rains.

17 (301). *Do. ariadne* (Linnæus). This, if distinct from the preceding species, is only doubtfully recorded from the district. It was included by Mr. J. A. Betham in his Matheran list.

18 (303). *Byblia ilithyia* (Drury). Comparatively common at Nandurbar in the Tapti Valley after the rains and probably to be found in other suitable localities also.

19 (314). *Atella phalantha* (Drury). Common everywhere.

20 (335). *Apatura ciminia* (Moore). This has been taken at Matheran, as recorded by Mr. J. Davidson in Vol. VIII of the Society's journal, and by Mr. Oliver. We have also found it at Khandala.

21 (343). *Precis iphita* (Cramer). Occurs throughout the district.

22 (344). *Junonia asterie* (Linnæus) and its dry season form *J. almana* (Linnæus). A common species, especially after the rains.

23 (347). *Do. lemonias* (Linnæus). Common throughout the district.

24 (349). *Do. hierta* (Fabr :) Common in all suitable localities.

25 (350). *Do. orithyia* (Linnæus). Common in all suitable localities.

26 (379). *Neptis lencothoe* (Cramer). This species, which for many years was known as *N. varmona* (Moore), is the common one of the genus throughout the district, being very numerous from October till February.

27 (400). *Do. ophiana* (Moore). Generally distributed throughout the district.

28 (402). *Do. jumbah* (Moore). Occurs in Salsette and at Matheran.

29 (419). *Hypolimnas bolina* (Linnæus). A common species.

30 (420). *Do. misippus* (Linnæus). Also a common species. The "*dorippus*" form of the female has been taken several times in different parts.

31 (440). *Parthenos virens* (Moore). We have seen this once at Vingorla.

32 (454). *Athyma perius* (Linnæus). Common on the ghâts and at Matheran. We know of no actual instance of it near the coast, but it may no doubt be found to occur.

33 (474). *Symphœdra nais* (Forster). This is a common species in Salsette and round about Bombay, but it does not appear to be found on the hills.

34 (513). *Euthalia garuda* (Moore). Common wherever there are mango trees about. This species is peculiarly susceptible to baits such as overripe fruit or a little toddy.

35 (517). *Do. lubentina* (Cramer). Not very rare on the hills including Matheran. It occurs occasionally in Bombay.

36 (520). *Pyrameis cardui* (Linnæus). Common in all suitable localities.

37 (544). *Cyrestis thyodamas* (Boisduval). Mr. E. H. Aitken found this "very common at Mahableshwar" during the cold weather of 1885-86. Dr. Smith includes a species of this genus as found at Matheran.

38 (556). *Kallima horsfieldii* (Kollar) [= *K. wardi* (Moore)]. Fairly common on all well-wooded hills.

39 (568). *Charaxes athamas* (Drury). Common enough on the ghâts and at Matheran.

40 (570). *Do. fabius* (Fabr:). Not so common as the preceding species, but also found on the plains. There are specimens in the Society's collection from the Tanna district.

41 (577). *Do. imna* (Butler). By no means very rare on the ghats and at Matheran.

FAMILY—LEMONIIDÆ.

SUB-FAMILY—LIBYTHÆINÆ.

42 (615). *Abisara echerius* (Stoll). After the rains very common on the hills and in the low jungles of the Tanna district. The local form was for many years distinguished as *A. fraterna* (Moore).

SUB-FAMILY—LYCÆNIDÆ.

43 (642). *Spalgis epius* (Westwood). Not a common species, but it occurs in Bombay and Salsette and at Karanja across the harbour.

44 (673). *Chilades trochilus* (Freyer). Common enough after the rains in Bombay and the Tanna district.

45 (681). *Cyaniris puspa* (Horsfield) Occurs on the ghâts and at Matheran. We have no record of it near the coast.

46 (694). *Zizera maha* (Kollar). A very common butterfly, especially after the rains. The closely allied *Z. karsandra* (Moore) has been recorded, but all our specimens would be referred to *Z. maha*.

47 (702). *Do. gaika* (Trimon). Occurs in Bombay and Salsette.

48 (703). *Do. otis* (Fabr :). The specimens from Bombay and Salsette that we have been able to examine would no doubt be placed by some in *Z. sangra* (704) or *Z. indica* (705), but there appears to be little doubt that they are merely synonyms of *Z. otis*.

49 (712).* *Lycænesthes lycænina* (Felder). Since Mr. E. H. Aitken wrote in Vol. I of our journal that he had a strong impression that he had caught this in Bombay, we have no definite record of its occurrence.

50 (715). *Talicada nyseus* (Guerin). This peculiarly distributed species is found at Mahableshwar, sometimes in swarms at some particular spot. It occurs also at Karanja across the harbour.

51 (733). *Jamides bochus* (Cramer). Not uncommon in Bombay and Salsette, especially after the rains.

52 (738). *Lampides ælianus* (Fabr :). Very common in Bombay and Salsette and more so on the hills.

53 (743). *Catochrysops strabo* (Fabr :). This species is to be found regularly in Bombay and Salsette.

54 (745). *Do.* *enejus* (Fabr:). A commoner species than the preceding.

55 (750).* *Do.* *pandava* (Horsfield). Our only definite record of this species is from Nandurbar in the Tapti Valley, but it doubtless occurs in other parts of the district.

56 (752). *Tarucus theophrastus* (Fabr :). A common species.

57 (758). *Do.* *plinius* (Fabr :). Occurs throughout the district, but is apparently nowhere very common.

58 (759). *Castilius rosimon* (Fabr :). Very common from August to the end of the year both on the hills and the plains.

59 (766). *Do.* *decidea* (Hewitson). This is apparently not a common species. It occurs occasionally in Salsette and Matheran.

60 (767). *Polyommatus bœticus* (Linnæus). Common everywhere.

61 (775).* *Iraota timoleon* (Stoll). This is found at Matheran, and Marshall and de Nicéville mention both Khandala and Ratnagiri as places where it occurs.

62 (776). *Do.* *mœcenas* (Fabr :). There are specimens in the Society's collection from the Tanna district, and it is also found occasionally in Bombay, though it is more common on the hills than near the coast.

63 (791). *Arhopala amantes* (Hewitson). This species occurs in Salsette and also across the harbour at Karanja, in fact in all hilly jungles. Further investigation should disclose other species of this handsome genus as occurring in this district.

64 (850). *Curetis thetis* (Fabr :). Occurs regularly, probably throughout the district.

65 (890). *Zesius chrysomalius* (Hübner). Marshall and de Nicéville record this species from "Alibagh in January, and March," and also at "Hasvira Kolaba district, in January."

66 (903). *Aphnœus vulcanus* (Fabr.). Fairly numerous in Salsette and on grassy hills everywhere: also at Nandurbar in the Tapti Valley.

67 (907). *Do.* *lilacinus* (Moore). Marshall and de Nicéville record a strongly marked specimen labelled "Bombay," received from the B. N. H. Society.

68 (910). *Do.* *lohita* (Horsfield). This has been taken at Pali Hill in Salsette. Dr. Smith includes it in his Matheran list.

69 (931). *Tajuria longinus* (Fabr.). This is not a common species, but it is found in Bombay, Salsette, and also on the hills.

70 (959). *Rathinda amor* (Fabr.). Occurs almost everywhere, but is nowhere common.

71 (967). *Catapœcilma elegans* (Druce). This species has been taken at Bassein in the Tanna district and at Janjira.

72 (977). *Loxura atymnus* (Cramer). This is evidently rare. Mr. W. E. Hart recorded the capture of one "about half a mile beyond the upper end of Vehar lake" in the Society's journal (Vol. IV, p. 69) and we took one at Andheri in Salsette in September 1901.

73 (986). *Deudorix epijarbas* (Moore). This is generally distributed, but nowhere common. Mr. J. A. Betham records it at Matheran in the Society's journal (Vol. VIII, p. 423), and it is also found occasionally in Salsette.

74 (995). *Rapala schistacea* (Moore). A specimen of this species is included amongst the few of Mr. Oliver's specimens from Matheran that we have been able to examine.

75 (1006). *Do.* *melampus* (Cramer). We have found this about Bombay, but it does not seem to be common.

76 (1012). *Virachola isocrates* (Fabr.). This is common enough near the coast wherever there are pomegranate trees, in the fruit of which the larvæ feed.

77 (1013). *Do. perse* (Hewitson). This apparently is not found near the coast, but occurs on the hills. It is common at Matheran.

FAMILY.—PAPILIONIDÆ.

SUB-FAMILY—PIERINÆ.

78 *Nichitona xiphia* (Fabr.). Common everywhere.

79 *Deltas eucharis* (Drury). Quite common all the year round.

80 *Catopsilia pyranthe* (Linn.). Common; sometimes to be seen in swarms.

81 *Do. crocale* (Cramer). This species, and the equally variable *C. catilla* (Cramer), which it is impossible to separate, is by no means an uncommon butterfly, especially during and after the rains, but at times for months together none are to be seen. At times too they migrate towards the south or south-west in countless numbers.

82 *Terias hecabe* (Linn.). Very common everywhere, after the rains appearing in swarms.

83 *Do. libythea* (Fabr.). This species occurs near the coast, and we have specimens from Rewa Danda, but it is apparently not by any means common, though it may often be overlooked amongst the far larger number of the other two representatives of the genus.

84 *Do. læta* (Boisduval). At times this is very common, especially during the cold weather, but at other times none are to be seen.

85 *Teracolus calais* (Cramer). The formerly recognised local species *T. cyprœus* (Fabr.) has now been sunk as an inconstant variety of the above. It is an extremely local species, as it never wanders far from the food-plant of the larva (*Salvadora persica*) which is a very ecentrically distributed tree. Near the tree the butterfly generally swarms. We have no record of it from the hills.

86 *Teracolus puellaris* (Butler). This common Gujerat species occurs at the northern limits of the Konkan. We have never heard of it in the neighbourhood or south of Bombay or on the hills.

87 *Do.* *danaë* (Fabr.). This is also a local species. Col. Swinhoe took it in Bombay during a famine year, and we found it lately in great numbers on Worli Hill, Bombay. It occurs—probably more or less regularly—in the Tapti Valley, being a common Gujerat species.

88 *Do.* *eucharis* (Fabr.). Cap. Watson considers this a distinct species from the next, *viz.*,

89 *Do.* *etrida* (Boisduval). They both occur commonly in Bombay and everywhere in the district, but no doubt are to be found locally all along the coast.

90 *Ixias marianne* (Cramer). Common everywhere.

91 *Do. pyrene* (Linn.) Common everywhere.

92 *Hebemoia glaucippe* (Linn.) This is a local species according as the food-plant of the larva (a kind of caper) is plentiful or not. It occurs all over the hills and is not at all uncommon in Salsette, while it has been seen occasionally in Bombay Island.

93 *Nepheronia gœa* (Felder). Quite common in Bombay and Salsette, especially after the rains, and everywhere throughout the district.

94 *Appias libythea* (Fabr.). Very common in Bombay and Salsette at times, especially before the rains.

95 *Huphina phryne* (Fabr.). This in its various seasonal forms is very common everywhere.

96 *Belenois mesentina* (Cramer). More or less common everywhere.

SUB-FAMILY—PAPILIONINÆ.

97 *Ornithoptera minos* (Cramer). Mr. E. H. Aitken records this from Karanja, across the Harbour, and also from Ratnagiri. It is probably carried great distances by the wind.

98 *Papilio hector* (Linn.). Occurs regularly about Bombay and Salsette. And also on the hills, and is very abundant in some years.

99 *Do. aristolochiæ* (Fabr.). Certainly more common than *P. hector*, occurring throughout the district.

100 *Do. agamemnon* (Linn.). Quite common all over the district, particularly about gardens.

101 *Do. sarpedon* (Linn.). Confined entirely to the hills, where it is common from October till the end of the year.

102* *Do. nomius* (Esper). In the Society's journal (Vol. I). Mr. E. H. Aitken mentioned specimens in the collection from "the ghâts which lie between the Tanna and Nasik districts." Besides this our only record is a single but unquestionable specimen observed by himself on Malabar Hill.

103 *Do. erithonius* (Cramer). Common everywhere.

104 *Do. pammon* (Linnæus). Quite common all over the district. Of the several forms of females the *polytes* type, which resembles *P. aristolochiæ*, is the commonest and the *romulus* type is not rare, but we have no record of the form that is similar to the male.

105 *Do. polymnestor* (Cramer). Quite common on the hills above 2,000 feet and occasionally found even in Bombay.

106 *Do. helenus* (Linnæus). This also occurs on the hills. It has been recognised beyond doubt by Mr. E. H. Aitken on Malabar Hill.

107 *Do. dissimilis* (Linnæus). This occurs in Bombay and Salsette, but is never to be seen in any numbers. It is also found at Matheran and on the ghâts.

SUB-FAMILY—HESPERIIDÆ.

108 *Celœnorrhinus ambareesa* (Moore). Found all over the district in suitable localities, but especially common on the hills.

109 *Celœnorrhinus leucocera* (Kollar). In Capt. Watson's book on the Indian *Hesperiidæ*, Col. Swinhoe is mentioned as having obtained this species in Bombay. We have not seen it within our limits ourselves.

110 *Sarangesa purendra* (Moore). Mr. J. A. Betham records this species in his Matheran list in the Society's journal (Vol. VIII).

111 *Do.* *dasahara* (Moore). Mr. R. C. Wroughton took this species at Bassein, Tanna district, as mentioned in the list in the Society's journal (Vol. I). We have taken it lately in Salsette.

112 *Coladenia tissa* (Moore). Mr. Aitken records two specimens taken "by Mr. R. C. Wroughton at Bansda, between the Surat and Tanna districts," in the second volume of the Society's journal.

113 *Hesperia galba* (Fabr.). This is not uncommon anywhere throughout the district.

114 *Suastus gremius* (Fabr.). Not uncommon in Bombay and Salsette. We have no record of it from the hills.

115 *Iambrix salsala* (Moore). Col. Swinhoe took this species in Bombay, and we have found it occasionally in Salsette lately.

116* *Taractrocera mævius* (Fabr.). Our only record of this species in the district is from one specimen taken last year by Mr. N. Marryat at Nandurbar in the Tapti Valley.

117 *Do.* *nicévillei*. This species, which was formerly known as *Ampittia coras* (Cramer), swarms in the grass in Bombay and Salsette during the hot weather and early part of the monsoon.

118 *Arnetta vindhiana* (Moore). To this species that formerly known as *Isoteinon nilghiriana* (Moore) is now sunk. It has been recorded by both Col. Swinhoe and Mr. Betham from Matheran.

119 *Matapa aria* (Moore). This species is probably more common than our records would appear to indicate. It is included by Dr. Smith in his Matheran list, but we have no definite instance of its occurrence since. It may be easily recognised by its bright red eyes.

120 *Gangara thyrsis* (Fabr.). About Bombay and Salsette this is by no means uncommon in certain localities, but as it does not come out till sun-down it may often be overlooked.

121 *Udaspes folus* (Cramer). This very conspicuous species is quite common in all suitable localities, including both the hills and the neighbourhood of Bombay.

122 *Telicota bambusæ* (Moore). Occurs in Bombay neighbourhood as well as on the hills, wherever bamboos grow.

123 *Baoris* (*Parnara*) *bevani* (Moore). Common about Bombay and Salsette.

124 *Do.* *do.* *guttatus* (Bremer and Grey). This species, which is closely allied to the preceding, is named by Capt. Watson as having been taken by Col. Swinhoe at Bombay.

125 *Do.* (*Chapra*) *sinensis* (Moore). [= *C. prominens*, (Moore)]. Not uncommon in Salsette, Bombay, and across the harbour.

126 *Do.* *do.* *mathias* (Fabr.). The commonest of the whole family all about the neighbourhood of Bombay, especially during the rains. The doubtfully distinct *B. agna* (Moore) has been recorded by Col. Swinhoe from Bombay.

127 *Hasora* (*Parata*) *chromus* (Cramer). Found everywhere throughout the district.

128 *Do.* *do.* *chabrona* (Fabr.). This species is recorded from Bombay by Col. Swinhoe under the name of *alexis*.

129* *Bibasis sena* (Moore). Mr. J. A. Betham records this in his Matheran list in the Society's journal (Vol. VIII.), having taken it in the "Mar-rai."

130 *Badamia exclamationis* (Fabr.). Common everywhere both on the hills and near the coast. At times hundreds may be seen migrating across the harbour at Bombay.

THE POISONOUS PLANTS OF BOMBAY.

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Part XX.

(With Plate V.)

(*Continued from page* 45, *Vol. XIV.*)

JATROPHA CURCAS, *Linn.*

Natural Order—Euphorbiaceæ.

Marathi :—जेपाळ=(*Jepâl*), मोगली एरंड=(*Mogli Erand*).

A large, low-branching, irregular, scraggy shrub.

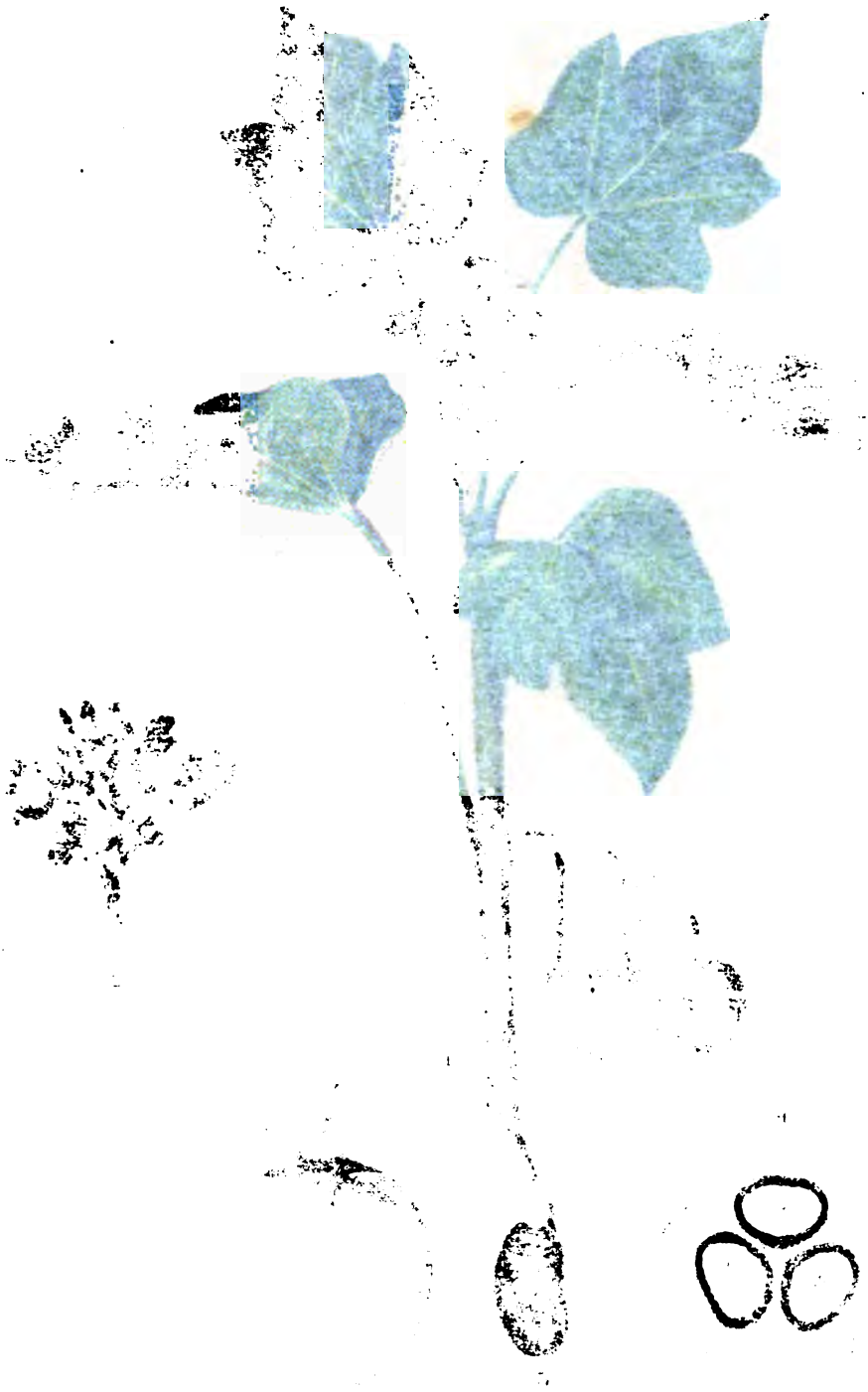
BRANCHES—irregular ; younger ones with close-packed leaves and green bark.

BARK—of older branches from one to two lines thick, light-green, covered with a thin pellucid or translucent paper-like epidermis which cracks and falls off in irregularly-shaped pieces. The bark on section with a penknife pours out copiously a thin translucent whitish juice which on exposure to air turns brown or even blood-red, and dries up in opaque tears or irregular masses. The bark of the oldest branches is light-ash-coloured, and has here and there innumerable yellowish spots of the size of a millet-seed.

WOOD—white, very soft and spongy ; pith well marked and dense in young and topmost branches. The wood, says Dymock, is loaded with starch.

LEAVES—scattered on the older branches ; closely packed at the top of youngest branches ; alternate ; the youngest leaves of a reddish tinge, with a tomentose under-surface, the tomentum disappearing as the leaf grows old and assumes a green color. Upper surface smooth. Shape broad-cordate, or orbicular-cordate ; 5-angled. Hence called "*Angular-leaved Physic-nut.*" Hooker says the leaves are 3—5 lobed, but as generally observed they are distinctly 5-lobed. Lobes 4—6 inches in diameter.

Nerves—otherwise called VEINS, well marked and prominent on the under-surface.



THE POISONOUS PLANTS OF BOMBAY

PETIOLES—as long as the blade ; round ; smooth ; inserted on a kidney-shaped projection of the bark and surrounded at the insertion by a thin expansion of the epidermis. STIPULES absent.

INFLORESCENCE.

Flowers monœcious, yellow, or yellowish-green ; pubescent ; in terminal corymbose cymes bearing many small flowers ; the central flower in the cyme or in its forks being always female. The flowers are scentless absolutely. The peduncle is often seen arising from exterior axils. BRACTS, entire small, one below each sub-division of the cyme, and generally one pressing on the calyx.

I.—MALE FLOWERS.

Found at the extremities of the ramifications of the main flower stalk, on short articulated pedicels ; deciduous.

CALYX—greenish ; sepals five, lanceolate, imbricate.

PRÆFLORATION, convoluted.

COROLLA—yellow ; ¼ inch in diameter ; petals five, ovate-oblong ; villous within. Hooker says that the corolla is salver-shaped ; Roxburgh says it is campanulate. It is the female corolla that is campanulate, as will be seen from my Plate V accompanying.

PRÆFLORATION, contorted.

STAMENS—many, says Hooker ; 8—10, says A. de Jussieu ; 6 says Roxburgh.

FILAMENTS—connate, says Hooker. A. de Jussieu describes them thus :—"Inferiorly connate, of which 3—5 are interior and larger than the outer ones." (Euphorbiacearum Genera, p. 37, Paris, 1824). Roxburgh, on the other hand, describes the arrangement of the filaments thus :—"Filaments *six*, the central one very thick and columnar ; the five external ones filiform, towards the base adhering to the central one ; all erect and a little longer than the calyx." The central mass of filamentous column represents the abortive Gynœcium.

ANTHERS—yellow ; often tinged brown. Says Roxburgh—"Ten, sagittate, equal ; five supported by the long central filament, and one by each of the others." Hooker describes the anthers as erect, 2-celled. The anther-lobes dehisce longitudinally from above downward. Anthers, says Baillon, are extrorse, dehiscing marginally. POLLEN—large, spherical. DISK—always present but varies in form. It is either a yellow entire ring, or is made up of five yellow glandules or squamules "The glands of the hypogynous disk are free or united" (Baillon).

II.—FEMALE FLOWERS.

Seated in the divisions of the male pedicels, "with their own pedicels *not articulated*" (Roxb.).

CALYX—as in the male flowers, but persistent.

COROLLA—as in the male flowers, but more substantial, and distinctly companulate.

DISK—not so well-marked as that of the male flowers.

STYLES—3; bifid or bi-lobed (A. de Jussieu); short. "Connate below or united in a slender column; glabrous" (Hooker).

STIGMAS—3; bifid, pubescent.

OVARY.—3-carpelled, each carpel containing one ovule; superior· "glabrous" says Hooker. Note that the ovary and styles are said to be pubescent in Jatropha curcas of Wallich (Syn.,—J. Wightianus),—Hooker. It may be noted here that at times only one ovule, or two, mature into seed. Very seldom have I seen the three ovules yielding three seeds. But that the three ovules do so yield three seeds will be seen from my illustrative plate accompanying this paper. The ovule is pendulous from the inner angle of the central column.

FRUIT—A tricoccous capsule; oval, or globosely oblong; 1—1½ inch long; ¾ inch broad, or even 1 inch; green when first formed; yellow when mature; brownish or black when dry. Hooker says there are 2—4 cocci, but I have never seen the fourth coccus.

EXOCARP—thick and succulent; fully of milky or pellucid white juice; 2 lines thick. Black or brownish, and easily removable when dry.

ENDOCARP—"crustaceous or bony" says Hooker.

SEEDS—½—¾ inch long; ⅜ inch broad; oblong; laterally attached about the middle of the cell, with a distinct white aril at the hilum; convex on the outer or dorsal side; angular on the inner or ventral side.* There is a well-marked ridge on the ventral surface (Dymock).

TESTA—smooth, black, crustaceous.

"The *lorica* and *tegmen*," says O'Shaughnessey, "are separable. The internal *tegmen* is hard, brittle, with resinous and brownish fracture; the almond is white, foliaceous, covered with a thin white membrane." This membrane is like tissue-paper and easily separable. The almond is inodorous, of agreeable taste, but slightly acrid after

* *Footnote.*—O'Shaughnessey's Bengal Dispensatory, p. 558, Calcutta, 1841.

chewing. It renders the saliva emulsive, and irritates the fauces (O'Shaughnessey).

ALBUMEN—" Fleshy " says Hooker ; " Copious and oily " says Dymock (Pharmacographia Indica, Vol. III., p. 276, Bombay 1893). It is best to speak of the " Albumen " as *Endosperm*.

COTYLEDONS—broad ; flat ; foliaceous ; adhering closely to the large mass of endosperm. The endosperm cells contain a net-work of protoplasm saturated with oil. This oil does not exist in the form of globules or drops, though it can be extracted by pressing the endosperm-tissue as in the case of the seeds of the castor-oil plant.

RADICLE—superior, short, thick.

EMBRYO—straight, central.

GENERAL REMARKS.

Jatropha curcas is an exotic, naturalized in India. It appears to be a free and rapid grower in this country, not wanting much care. It is a hardy plant, which has taken quite kindly to the soil of Western India whether it be in the Konkan or in the Dekkan. In both these divisions of Western India, I have seen it grow profusely as a hedge-plant, where no human hand has watered it. It evidently takes its nourishment from the air, and from the soil in which it grows, depending mainly on the rain-water and dew, whenever it can get it. In the Konkan it gets its water-supply from the monsoon rains from June to October. Hooker says that the plant is ever-green. It is not so in the Konkan. I have seen that in the Thana and Ratnagiri districts it is leafless, though in inflorescence during April and May. Nay, in 1898 in Satara (Dekkan) I found the plant leafless in January and February. The plant is a native of Brazil and of the West Indies. From Brazil it is said to have been introduced here by the Portuguese (Dymock). It may be so ; it is probably introduced here from Northern Africa also, by way of Arabia. No mention appears to have been made of this plant by Henrique Van Rheede in his elaborate work entitled *Hortus Indicus Malabaricus* published at Amsterdam in 1678 in six folio volumes, fully illustrated with the aid of three local Pandits—Rango Bhat, Vinayak Pandit, and Appa Bhat. The Marâthi or *quasi-Marâthi* letter-press of the preface these three Pandits then wrote is very characteristic of the Marâthi spoken and written in Malabar in the seventeenth century.

Jatropha curcas, however, appears to have been mentioned in Bhâv-Prakash, a Sanskrit work describing several Indian plants. "Its author, Bhâv Misra," says Dattaram Chobhe, "flourished in Madras about 350 years ago." Surgeon-General Balfour of Madras says that Bhâv Misra flourished so far back as 1550 A. D. It is possible then that the Portuguese must have introduced the plant into India. Sir George Birdwood says that "Jatropha curcas was first mentioned by *Monardes*" (Veg. Products, Bombay Presidency, page 77 and page 308, 2nd ed. Bombay, 1865). *Monardes* is evidently a misprint for *Monardus*, for no such name as *Monardes* is mentioned by Professor Sachs in his History of Botany (1530—1860), published at Würzburg in 1875, and translated into English by Garnsey and Professor Balfour in 1890 (Oxford). I find, however, from John Gerarde's *Herball* that Thomas Johnson, an Apothecary of London who re-edited Gerarde's Herball in 1663 A.D., mentions an American writer named Nicolas Monardus. Johnson, in addressing his readers in a prefatory note, speaks of Nicolas Monardus as being a writer on the simple medicines of the West Indies. Evidently Monardus flourished about the middle or end of the sixteenth century. From Johnson's remarks in Gerarde, I find that the works of Monardus, originally written in Spanish, were translated into Latin by Carolus Clusius between 1583 and 1601. "Carolus Clusius," says Johnson, "was a learned, diligent, and laborious *Herbarist*." Carolus Clusius, a Frenchman by birth, was otherwise named Charles de l'Écluse. He was born in Arras in 1526. His family suffered from religious persecution in France, and he spent the greater part of his life in Germany and the Netherlands. In 1573 he was invited to the Imperial Court of Vienna by Maximilian II. Clusius accepted the invitation and removed to Vienna. Subsequently in 1593 he became Professor of Botany in Leyden and died there in 1609 (Sachs).

O'Shaughnessey notes that Jatropha curcas is a native of New Andalusia and Havana (in the Island of Cuba). A. de Jussieu says that it is also a native of North Africa. Now, it is a well-known fact that India, especially its Western Coast, and North Africa, through Arabia, have for several centuries past been in close mercantile intercourse with each other. It is, therefore, just possible that Jatropha curcas was introduced into India by the mercantile Arab and Afric visitants of the shores of Western India. But I have no authentic information on this point. It is a mere surmise of mine. The Afric coast has given to the

Ratnagiri Coast a class of fishermen called the *Dâldis* who are distinctly of Afric blood and origin. Possibly their progenitors brought the plant with them. Why not?

In English parlance the plant is known as the *Physic-nut* or the *Purging-nut*. It must be noted that it is quite different from the plant known as *Poison-nut* which is Strychnes Nux-Vomica. The seeds of Jatropha curcas are known as *Pignons d'Inde* (Dymock). The oil obtained from the seed is spoken of as *Oleum infernale* by Professor Dr. L. Lowin of Berlin (page 374, Lehrbuch der Toxikologie, 1897). The oil is similarly spoken of by Dymock thus :—"It was formerly employed as a purgative by European physicians under the names of *Oleum Ricini majoris* and *Oleum infernale*." Roxburgh says that the plant is one of the most common on the Coromandel Coast, and in flower and fruit all throughout the year. This fact is worth noting, as showing the effects of local influences on the growth of plants. Talbot of Canara fixes a definite time for flowering and fruiting. That of flowering from April to May ; that of fruiting during the rainy season. I must note here one important remark which Roxburgh makes regarding the wood of the plant. In observing that the wood of Jatropha curcas is too soft and spongy to be of any use he cogently adds that the wood "will not even burn freely."

With regard to the oil expressed from the seeds, O'Shaughnessy and Roxburgh say that it is used to burn in lamps by the poorer classes of the natives of Bengal. I am not aware that it is used on this side of India for any such purpose. But in America it appears to be so used freely.

In noticing this plant as an exotic in his Flora of Ceylon (Vol. IV., p. 46, London 1898), Dr. Trimen says that it is very commonly planted as a fence round native gardens, and that it is a violent purgative.

Dymock says that Jatropha curcas is said to have been introduced from Brazil by the Portuguese. Sir George Birdwood gives South America as the *habitat* of the plant. The plant seems to be well-known in China, as the Chinese turn out a fine black varnish by boiling the seed-oil with Oxide of Iron. Dr. Dymock observes that the juice of the plant, when dried in the sun, forms a bright reddish-brown, brittle substance like shell-lac, which may yet be put to some useful technical purpose (Pharmacogr. Ind., Vol. III., p. 275). A similar remark is made by Dalzell and Gibson :—"The fresh juice of the stem when

dried forms an elegant lac-like substance, which may yet be applied in the Arts" (p. 77, Supplement, Bombay Flora, Ed. Soc. Press, 1861).

Though the oil of the seeds of Jatropha curcas is largely used in lamps in the different parts of India mentioned above, it is known in European commerce as the "seed-oil" (G. Birdwood). No such oil that I am aware of is exported from India. So says Sir George Birdwood also.

In a work entitled "A General System of Botany" by Emm Le Maout and J. Decaisne, translated by Mrs. Hooker in 1873, London, Longmans, Green & Co., at page 698, I find the following remark which is well worthy of the consideration of Indian soap-makers. The remark runs thus :—"The seeds of Jatropha curcas [Physic-nut], a shrub growing throughout the hot countries of America, yield a plentiful supply of an oil of which soap is made."

Garcias de Orta, in his Colloquies on Indian Plants, mentions a plant named *Jatropha* (see p. 79, 2nd Edition, Lisbon, 1872). Whether it is the same as Jatropha curcas or not I am not able to determine.

The following are the SYNONYMS of Jatropha curcas, *Linn.*, as given in Hooker's Index Kewensis (pages 1251-1252, Part II, 1893, Clarendon Press, Oxford) :—

1. Jatropha acerifolia, Salisb. Prod. 389.
2. J. condor, Wall. Cat. N. 7799.
3. J. curcas, Wall. Cat. N. 7799 D—Wightiana.

Note that there is a plant called Jatropha peltata, figured by Wight in his plate 1169 in the Icones Plantarum which is the same as Jatropha Wightiana, referred to above under synonym No. 3. Note again that what Wight depicts as Jatropha villosa in plate 1159 of his Icones is said by the Compiler of the Index Kewensis to be nothing but Jatropha Wightiana. The older writers speak of this plant as Curcas purgans. Beck says it is the *Tuva tree* of the Philippine Islands. It is also known as *Indian nut*.

In a list of five hundred Indian plants published in Canarese at Mangalore by the Basel Mission Book and Tract Depository under the authorship of C. Stolz, the following synonyms are given :—

(1). Castiglionia lobata, R. B.
(2). Ricinus americanus, Mill.

(Page 11, 2nd Ed., 1891).

It may be noted here that like the leaves of the Castor-oil plant (Ricinus communis, *Linn.*) the leaves of Jatropha curcas have galactagogue properties. A decoction of the leaves is used in the Cape de Verd Islands to excite secretion of milk in women (A. A. B. in Maunder's Treasury of Botany, Part I, page 363, Edition 1870). Dr. Bennett of Sydney (Australia) is credited with having made the following observation in his work entitled *The Gatherings of a Naturalist* :—

" The milky acrid glutinous juice, when dropped on white linen, produces an indelible stain, at first of a light-blue colour, but after being washed changes to a permanent brown : it might, therefore, form a very excellent marking ink." I have not been able to obtain such a stain. Will any of my readers help me in settling this point ? The oil of Jatropha curcas seeds is said to be of a light colour, and used as a substitute for Linseed oil, as well as for dressing cloth (Maunder's Treasury of Botany). It is also said to form a basis for the red dye of the cotton fabric known as *Turkey red.*

The following remarks are made with the object of engaging the attention of those earnest students of plant-life who are interested in the investigation of the question as to how the environment of a plant in the Eastern and Western hemispheres respectively affect the existence and growth of any particular genus or species of this or that plant. It is well-known that several members of the Euphorbiaceæ, like several members of the Cactaceæ, are succulent plants. Strictly speaking, Jatropha curcas is not a succulent plant, but at all times of the year in Tropical East India, especially on the coast of Western India, in the Konkan and in the Dekkan, it is rich in a milky juice. Such plants, rich in milky juice all throughout the year, may during their existence in the hot weather be aptly compared to camels—as the " ships of the desert." Indeed, they provide for themselves a large quantity of water and are then able to dispense with further supplies for a long time without injury. " The cells of the aqueous tissue are comparatively large, and their walls thin ; the active protoplasm within forms a delicate layer round the walls—that is to say, a sac whose cavity is filled with watery, often mucilaginous fluid." These remarks of Kerner Von Marilaun's (Oliver's Translation, History of Plants, p. 328, Vol. I., 1894, London) may well apply to Jatropha curcas.

It may be noted here that the flowers of Jatropha curcas besides being odourless don't appear to be invaded by insects. Cattle wont touch

its leaves. Hence as a hedge-plant it is very serviceable as already noted in my foregoing remarks. I may here emphasize the fact that Jatropha curcas is one of the Euphorbiaceous plants in which each plant without exception develops both true staminate and pistillate flowers on one and the same flower stalk. It must be further observed that the members of the Euphorbiales, not to speak of the genera only but also of the specimens of the species and varieties locally obtained, differ at times very widely in individual development of parts of the plant under local influences of soil and climate. But what I have noted above is the result of my personal observation of this plant in its living condition in Bombay, Thana, Satara, and Ratnagiri.

I have noted above that Dr. Dymock speaks of the seed of Jatropha curcas as *Pignon d'Inde*. Just a word of warning to my readers. I find from Baillon's Natural History of Plants, translated from his elaborate French work by Marcus Hartog, that there are two kinds of *Pignon d'Inde, viz.*—the large and the small. The large one is the seed of Jatropha curcas, otherwise called by Baillon as the Jatropha of Barbadoes (Castiglionia lobata, *R. et Pav.*). The small *Pignon* of India is the seed of Croton Tiglium, the oil of which is much more deadly (p. 162, Vol. V., 1878, London. Baillon's Translation into English by M. Hartog.)

From Paxton's Botanical Dictionary it appears that Jatropha curcas was introduced into England from South America in 1731. It is noted as an ever-green plant (p. 310, Edition by S. Hcreman, 1868, London).

Baillon remarks that the wood of Jatropha curcas is "soft, easily decaying; palisades are however made in the Indies" (West—*K. R. K.*). Baillon further adds that Jatropha curcas is used for hedge rows in the Antilles (Marcus Hartog's English Translation of Baillon, Vol. V., p. 175).

POISONOUS PROPERTIES.

The seeds of *Jatropha curcas* are poisonous. They produce, when taken internally, vomiting and drastic purging. The oil obtained from the seeds has similar effects. "The seeds are employed by the native doctors of the Philippine Islands and considered excellent and mild purgatives in doses of from one to four seeds. The effects which result from an overdose are vomiting, purging, a burning sensation in the

stomach, with a determination of blood to the head. * * * Dr. Bennett, the well-known naturalist of Sydney, has himself administered these seeds to Europeans, but has found their effects very irregular, and occasioning, in all cases, a burning sensation in the bowels followed with nausea and vomiting" [*A. A. B.* in Maunder's Treasury of Botany].

Beck says that the effects of seeds are at times so great that in addition to vomiting and purging there is insensibility, and great weakness followed by death. Violent inflammation of the mucous membrane of the stomach and intestines has also been noted (p. 832, Medical Jurisprudence, 5th Edition, London, 1836).

The following is an extract from Dr. Hilton-Fagge's Report on Toxicology and Materia Medica (p. 347, New Sydenham Society's Year-Book, 1865, London):—"In the *Medical Times and Gazette*—(London, 1864, I. 703)—are recorded several cases of poisoning" by the seeds of *Jatropha curcas*, "which occurred at Birmingham, where three or four sacks of the nuts were sold by auction. These nuts were left on the floor, and some boys, getting access to them, put some into their pockets, and finding their taste pleasant not only ate some of them themselves, but gave others to their friends. In consequence thirty-three persons were taken so ill as to be obliged to be carried to the General Hospital. Some of them had only eaten three or four of the nuts, but others ate as many as fifty. Symptoms came on in some cases in ten minutes; in others not until two to two hours and a half had elapsed. The chief effects were pain and burning in the throat, pain and distension of the abdomen, giddiness, vomiting and drowsiness; and after an interval, purging—the evacuations being copious, mucous, and not unlike the rice-watery stools of cholera. In some cases the depression was very great; in many there was dysuria; fever was always present as an after-effect. Dilatation of the pupils was believed to exist in those who took a large quantity of the poison. It is doubtful whether the drowsiness—from which the patients were easily roused—was a narcotic effect of the nuts or whether it was caused by the great prostration." [*N.B.*—I am inclined to think the latter caused drowsiness—*K. R. K.*] Strangely enough, all the cases recovered! The treatment consisted of the administration of emetics and purgatives. Will not the Homœopaths say "*Similia similibus curantur?*"

Dr. Norman Chevers* quotes a case reported by Morrett of Salem (Madras Presidency), and fully detailed in the Madras Quarterly Journal of Medical Science, p. 37, July 1861. The case was that "of a healthy young English gentleman, who ate fifteen or twenty nuts of *Jatropha curcas*. The taste did not arouse suspicion. In an hour and-a-half burning sensations in the throat and stomach were felt, attended with great restlessness. There was profuse purging, with great pain and vomiting, by which portions of the nut were rejected. In another hour and-a-half there were severe cramps of the lower limbs. The purging now ceased. The cramps were so violent that frequently the patient sprang in agony out of bed, and stamped his feet with all his force upon the ground as if to flatten them, the cramps distorting them. The cramps affected, with less severity, the muscles of the arms, abdomen and back. Occasionally there were convulsive twitches of the back, almost like those in tetanus. He gradually became perfectly deaf. There was also impairment of sight. The pulse was very small, thready and weak. Skin cold, damp, and clammy. Features sunken and contracted. *Treatment*— Hot brandy and water, warm bath, anodyne frictions, and hot bottles. In about seven hours reaction set in and he slowly improved. Throughout the following day he remained totally deaf, and had slight cramps. Next day he was awakened by the church bell, and was quite convalescent. Although during his illness he had appeared quite conscious, he had no recollection whatever of what happened later than the profuse purging. Several other young gentlemen were in like manner affected in a less alarming degree, having taken fewer of the nuts, but in none of them was there deafness or loss of memory." In giving this long extract from Chevers my only apology is that his work is out of print now. My quotation, therefore, is likely to be of use to those who do not happen to have his work in their library.

So far as I know, the seeds of *Jatropha curcas* have never been used for criminal poisoning. Brigade-Surgeon Lyon, C.I.E., in his Medical Jurisprudence (p. 205, Ed., 1889, Calcutta) says that several cases of *accidental poisoning* are recorded. My foregoing observations will amply bear him out in his assertion.

* Medical Jurisprudence for India, p, 275, Calcutta, 1870. Thacker, Spink & Co.

To add further evidence with regard to the poisonous nature of *Jatropha curcas* I quote Sir Robert Christison of Edinburgh. He observes that the seeds of the physic-nut of the West Indies, "when applied in the form of powder to a wound, produce violent spreading inflammation of the subcutaneous cellular tissue; and when introduced into the stomach they inflame that organ and the intestines. Four seeds will act on man as a powerful cathartic. I have known violent vomiting and purging occasioned by a few grains of the cake left after the expression of the fixed oil from the bruised seeds; and in some experiments, I performed a few years ago, I found that from twelve to fifteen drops of the oil produced exactly the same effects as an ounce of castor oil, though not with such certainty" as that of castor oil, I presume. [*K. R. K.**].

I offer to my readers the following quotation from A. S. Taylor's Medical Jurisprudence (2nd Ed., Vol. I., p. 328):—

"In August 1858, 139 children in Dublin suffered severely from eating some of these nuts, namely, of *Jatropha curcas* (*Medical Times and Gazette*, August 1858). They all recovered." * *

"M. Chevalier refers to a case in which thirty-three persons were poisoned by eating these seeds. The symptoms which they suffered from were nausea, vomiting, and general depression. Twenty were so ill that they were placed in the beds of an hospital; the remaining thirteen soon recovered."

In 1871, when a student in Grant Medical College, Bombay, I ate two seed-almonds of *Jatropha curcas* which was then growing near the Vehar water-pipe in the College garden in front of the Clock-tower. I suffered from the effects of the almonds for fully six hours, though the nuts were pleasant to eat. My friend and fellow-student Khan Bahadur Dr. K. B. Cooper, now Civil Surgeon of Shikarpur, also ate some with me. Perhaps he will remember the incident. I remember it very well, as the emesis it produced was very trying. My medical attendant, Dr. Sakharam Arjun, of sacred and loving memory, then living in the same house with me, gave me a word of warning not to play pranks with my life in the course of my botanical studies by tasting unknown plants, merely for the sake of experiment. Such foolhardiness, I know, has often destroyed valuable lives. There is a saying in Marathi जेपाळाची यात्रा ॥ वैकुंठाची यात्रा,

* Christison's Treatise on Poisons, p. 591, 4th Edition, Edinburgh, 1845.

which means that if *jepal* is recklessly used, death is the result (Mr. G. S. Bhide, Jailor, Ratnagiri Prison).

As regards the seat of the poisonous element, O'Shaughnessy says that it is the *embryo* which is the source of the acridity of the seed and its poisonous nature. I doubt this very much. I feel almost sure, that the acridity and the poisonous principles lie in the once so-called albumen, and now called the endosperm. I do not at all believe, as suggested by O'Shaughnessy, that the removal of the little, insignificant embryo rids the nut of its poisonous property and makes it "bland and alimentary." Although this statement is made by O'Shaughnessy on the high authority of M.M. Feé and Humboldt, I must set my face humbly against it.

I find myself "all at sea" with regard to the chemical nature of the poisonous element of *Jatropha curcas*.

The active principle of the oil of *Jatropha curcas*, says Râi Bahadur Kanny Lall Dey, F.C.S. of Calcutta, has been named *Jatrophic acid*. A recent research (A. Siegel, 1894) attributes the activity of the seeds to a poisonous *toxalbumen* analogous to *Ricin* and named *Curcin* (p. 169, Indian Drugs, 2nd Edition, 1896, Calcutta). *Ricin*, says J. Charles E. Sohn, F.C.S., a member of the Society of Public Analysts of London, is a poisonous principle of castor seed of the *albuminous* kind (p. 191, Index to a Dictionary of the Active Principles of Plants, 1894, London). Dymock observes that Dr. H. Stillmark has discovered in the seeds of *Ricinus communis* an albuminoid body which has been named *Ricin*. This, however, says Dymock, does not appear to be the purgative principle (p. 277, Ph. Ind., Vol. III.). It may be noted that *Ricin* appears to have a peculiar effect on blood, causing a rapid conglomeration of the red corpuscles, together with the formation of a substance like fibrin.

The oil of *Jatropha curcas* is said to contain an active principle similar to that of the castor seeds. It is known as Ricinoleic acid. Its formula is $C_{18}H_{34}O_3$. It occurs as a glyceride in castor oil together with *tripalmatin* and tristearin. It also occurs in *Jatropha curcas*. It is a thick oily liquid which solidifies below 0° C., and mixes in every proportion with alcohol and ether. Its alcoholic solution has an acid reaction, an unpleasant persistent acrid taste, and does not oxidize in the air (Roscoe and Schorlemmer's Treatise on Chemistry, Vol. III; Organic Chemistry, Part II, p. 484, Edition, 1890, Macmillan).

I must not omit to mention here what Professor Schmiedeberg of the University of Strassburg says regarding the active principle of Castor oil. He says:—"It is soluble in the intestinal fluids only; here alone it meets with the conditions necessary to its efficiency after it gets into the bowels. Like Croton oil, Gamboge and Jalap resin, Castor oil is insoluble in watery fluids, and consequently passes the stomach unchanged. In the intestines it is dissolved by the alkalies of the bile and pancreatic juice."* These remarks may well apply to the seed-oil of *Jatropha curcas*.

DESCRIPTION OF PLATE V.

Fig. No. 1. *Jatropha curcas*, $\frac{1}{6}$ natural size sprig with diminutive inflorescence and tender red leaf.

„ 2. Natural size inflorescence, with the companulate female flower.

„ 3. Fruit natural size.

„ 4. Transverse section of natural sized fruit with tricoccous arrangement, showing a seed in each coccus.

„ 5. Seed. Natural size, showing the white aril at the top.

* Elements of Pharmacology, translated by Dixon of the University of Sydney, pp. 108 and 109, Edinburgh, 1887.

THE BIRDS OF THE MADHUBANI SUB-DIVISION OF THE DARBHANGA DISTRICT, TIRHUT, WITH NOTES ON SPECIES NOTICED ELSEWHERE IN THE DISTRICT.

By C. M. Inglis.

Part VI.

(*Continued from page* 771 *of Vol. XIV.*)

Order—GAVIÆ.

Family *Laridæ*.

(254) Larus ichthyaëtus.—The Great Black-headed Gull.

Blanford, No. 1489; *Hume*, No. 979.

A rare gull in the district. Though I heard from one of my men about a large gull several times it was not till the 18th of last December that I obtained one. A *mir-shikar* in my employ brought me a live one which had got snared in a noose at the Maiser Chaur. I kept it for several days in my water aviary, but it died. All gulls are known here as "*Kheir*."

(255) L. ridibundus.—The Laughing Gull.

Blanford, No. 1490; *Hume*, No. 981.

This species is also rather rare. I have only succeeded in getting three specimens, one being in breeding plumage which was got on the 11th March. They were obtained from November to March. I have never seen more than one of this species on the same marsh.

(256) L. brunneicephalus.—The Brown-headed Gull.

Blanford, No. 1491; *Hume*, No. 980.

This is the common gull on the marshes in the vicinity of Baghownie and a few are also met with on the Keray River. I never came across any gulls in the sub-division though they are certain to occur on the Minti and Sumda chaurs. On the Maiser Chaur these gulls are, I believe, to be found in fair numbers throughout the cold weather. It was some time before I procured specimens, as on the marsh which I shot over they were rather wary. These gulls settle a lot on the water and nearly always where cormorants (*P. javanicus*) are feeding, and for many days my man used to hit the latter birds instead of the gulls. They seemed to have a charmed life and it was not till the 31st January 1902 that the spell was broken. All my specimens were got from November to the middle of March and none had assumed the breeding plumage. The stomachs of all the gulls I have examined have contained nothing but fish.

(257) L. cachinnans.—The Yellow-legged Herring-Gull.

Blanford, No. 1495; *Hume*, No. 978 *bis*.

Rare. A single immature specimen was procured on the Kokoron Chaur on the 4th March 1902 and brought to me by a *mir-shikar*. He had caught it with birdlime.

Sub-family *Sterninæ*.

(258) HYDROCHELIDON HYBRIDA.—The Whiskered Tern.

Blanford, No. 1496 ; *Hume*, No. 984.

Very common. They occasionally breed here during July and August in tanks. I sent a note on their breeding here, to this Journal some time ago. Native name for all terns *Tehari*.

(259) HYDROPROGNE CASPIA.—The Caspian Tern.

Blanford, No. 1498 ; *Hume*, No. 982.

A rather scarce cold weather visitant. I have only four specimens. I got one in November, two in February and one on the 16th of March. They are rather wary birds. The one shot in November was a perfect specimen, but with no white on the lower lores. This bird, which was only wounded when hit, uttered the harsh cry as recorded by Hume.

(260) STERNA ANGLICA.—The Gull-billed Tern.

Blanford, No. 1499 ; *Hume*, No. 983.

This species is also rather scarce and is seldom seen after February. I saw one in breeding plumage on the 28th March flying over the indigo fields at Baghownie.

(261) S. SEENA.—The Indian River-Tern.

Blanford, No. 1503 ; *Hume*, No. 985.

Very common. It breeds on the sand banks of the Kamla in March and April.

(262) S. MELANOGASTER.—The Black-bellied Tern.

Blanford, No. 1504 ; *Hume*, No. 987.

Not quite as common as the former species. They breed at the same time and place as *seena*.

(263) S. FULIGINOSA.—The Sooty Tern.

Blanford, No. 1514 ; *Hume*, No. 992 *bis*.

I have nothing further to add to my note on this species already sent to our Journal.

Sub-family *Rhynchopinæ*.

(264) RHYNCHOPS ALBICOLLIS.—The Indian Scissors-bill.

Blanford, No. 1517 ; *Hume*, No. 995.

Rather scarce. A few are however generally seen on the banks of the Kamla near Jainagar during July and August.

ORDER STEGANOPODES.

Family *Pelecanidæ*.

(265) PELECANUS ROSEUS.—The Eastern White Pelican.

Blanford, No. 1520 ; *Hume*, No. 1003.

A fine female caught by a *mir-shikar* with birdlime in the Benoa Chaur on the 17th July 1901. It was alone preening its feathers near the edge of the water. This is the only one that either I or my men have ever seen in the district. Native name *Ganggoya*.

(266) PELECANUS ONOCROTALUS.—The Roseate Pelican.

Blandford, No. 1521 ; *Hume*, No. 1001.

I have just received on the 17th March a female of this species or rather what I should say was intermediate between *onocrotalus* and *roseus*. It is a fine bird very deeply suffused with pink. It has got the 24 rectrices of *onocrotalus* but the bill is too small for that species, being only 14″·8. The frontal region is also much swollen. The measurements taken in the flesh are as follows:—*length*, 63″·5; *wing*, 27″; *tail*, 7″·5; *tarsus*, 5″; *bill at gape*, 14″·8 and *expanse* 108″·25. A female of *roseus* was also brought in from the same place, *viz.*, the Maiser Chaur. Native name *Jalasind*.

(267) PELECANUS PHILIPPENSIS.—The Spotted-billed Pelican.

Blanford, No. 1523 ; *Hume*, No. 1004.

Rather common. This species is met with from the end of June to the beginning of October. They frequent tanks, rivers and marshes.

Native name *Koorair*.

Family *Phalacrocoracidæ*.

(268) PHALACROCORAX CARBO—The Large Cormorant.

Blanford, No. 1526 ; *Hume*, No. 1005.

Not very common, only found during the cold weather. I have never seen many together, but Mr. Scroope wrote me that he had seen considerable numbers at Awari on the 21st February. Native names *Gandil and Kurruk*.

(269) P. FUSCICOLLIS.—The Indian Shag.

Blanford, No. 1527 ; *Hume*, No. 1006.

This species is, I believe, to be obtained on the Maiser Chaur. The *mir-shikars* know it well and say they have seen it there. Native name *Ganowli*.

(270) P. JAVANICUS.—The Little Cormorant.

Blanford, No. 1528; *Hume*, No. 1007.

Uncommon in the north of the district but common elsewhere. I have never found it breeding, though I have seen it all the year round near Baghownie. Near that Factory and about the end of July a large number frequented a piece of water near which there were some mango trees. I hoped they would breed, but they left the neighbourhood without doing so. I am certain they must breed somewhere near here. Native name *Ghogur*.

Sub-family *Plotinæ*.

(271) PLOTUS MELANOGASTER.—The Indian Darter.

Blanford, No. 1529 ; *Hume*, No. 1008.

Mr. Scroope met this species near Jhanjiarpur and Mamgachi, at the latter place on the 9th January. I have never come across it, but received specimens snared by a *mir-shikar* somewhere in the district. Native name *Banwa*.

ORDER—HERODIONES.

Sub-order PLATALEÆ.

Family *Ibididæ.*

(272) IBIS MELANOCEPHALA.—The White Ibis.

Blanford, No. 1541; *Hume,* No. 941.

Scarce in the sub-division except near Minti, where a flock of about fifty was seen in February. The 27th May is the latest date on which I have got this species; a fine male in breeding plumage being secured on that date. The testes were greatly enlarged. The skin of the wing in the young bird is fleshy. I have not found this species breeding here. Native name *Hasoo dabil.*

(273) INOCOTIS PAPILLOSUS.—The Black Ibis.

Blanford, No. 1542; *Hume,* No. 942.

Very common. I have taken eggs from March to August. A pair commenced building on the 23rd September, but deserted the nest. Most of the nests were on Simul (*Bombax sp.*), generally single, though I have found two nests close to each other. One nest with two fresh eggs was found on a pipal (*F. religiosa*). It was an old nest of *O.calvus,* but the Ibises had lined it with mango leaves and grass. This is called the "Planter's Friend" by many Europeans on account of the number of crickets they kill in the indigo fields; some people also call it the curlew. Native name *Karánkal.*

(274) PLEGADIS FALCINELLUS.—The Glossy Ibis.

Blanford, No. 1544; *Hume,* No. 943.

I never came across this species in the sub-division, but it is fairly common at some distance from Baghownie, on the Chilwara Chaur from March to May. I have not found it breeding here. The head is the last to change into breeding plumage. I have a bird with the back and wings in breeding plumage, and also getting some chestnut feathers in the lower plumage, but the head is in winter plumage. Native name *Kávaira.*

Family *Plataleidæ.*

(275) PLATALEA LEUCORODIA.—The Spoonbill.

Blanford, No. 1545; *Hume,* No. 939.

I have seen few spoonbills near Jainagar and Narhar, but Scroope saw a big flock containing 42 birds at Kolwahi, a village a few miles from Narhar. One of my men says he saw about a couple of hundred on the Minti Chaur in February. I have got specimens from November to the middle of April. Native name *Koorpia dabil.*

Sub-order CICONIÆ.

Family *Ciconiidæ.*

(276) CICONIA ALBA.—The White Stork.

Blanford, No. 1546; *Hume,* No. 919.

Very common during the cold weather. They arrive about the end of October and remain to the end of March. Numbers are snared by the *mir-shikar* with birdlime. Sometimes they are very tame and I have shot them dead with No. 6 shot. Native names *Ghybur* and *Burra Retwa.*

(277) C. NIGRA.—The Black Stork.

Blanford, No. 1547 ; *Hume*, No. 918.

A scarce winter visitant. They also remain till March. My men generally come across one or two every cold weather and have several times fired at them but never succeeded in getting one yet. Once I had a shot at one as it flew over my bungalow at Narhar but it was rather far off for the cartridges I had. I think this is the species the *mir-shikars* call *Mullaik* but cannot be certain till they bring me one in.

(278) DISSURA EPISCOPUS.—The White-necked Stork.

Blanford, No. 1548 ; *Hume*, No. 920.

Very common. Simul trees are the favourite sites for their nests ; one nest was taken on a pipal. Usually only a single nest is found on the one tree but I have found two touching each other. The earliest nest with eggs was taken on the 15th July, and the latest on the 28th October. They do lay earlier, as a female shot by Mr. G. Dalgliesh on the 3rd June had in the oviduct an egg ready for ejection. This bird had a nest on the tree on which she was shot ; on going there a month later I found the cock-bird had paired again. I took some young in down from a nest on the 15th August. Feathers commenced to appear on the head, back and wings on the 20th, and by the 13th September the whole body was covered with them. These birds had perfect liberty and flew away on the 8th October. Most of the day they rested on their tarsus and when about to be fed used to emit a peculiar gutteral sound which seemed to come from far down in the throat. A young bird whilst feeding in a field at Narhar began to stagger and fell. There was some *seet* water in the field and it must have imbibed some of this which evidently had an intoxicating effect on it. Native names *Lag lag* and *Retwa*.

(279) XENORHYNCHUS ASIATICUS.—The Black-necked Stork.

Blanford, No. 1549 ; *Hume*, No. 917.

I have found this species decidedly rare here, but Mr. G. Dalgliesh writes in the *Zoologist* "a not uncommon resident." I got one, a young female at Narhar in December 1898, and Mr. Scroope sent me the following note on the 19th January 1900 :—"What interested me beyond anything was the discovery of the black-necked stork at the latter place (Kachara). I got quite close to a pair which were wading . . . . I saw several huge storks at Minti also which I feel sure were this species." Some *mir-shikars* saw some at the Benoa Chaur about the end of July but failed to snare any. I have a couple of fine adult birds got in August. Native name *Loha sarang*.

(280) LEPTOPTILUS DUBIUS.—The Adjutant.

Blanford, No. 1550 ; *Hume*, No. 915.

Rather scarce. They arrive in June and I have seen them up to December, one being brought me on the 21st of that month. It is very seldom, however, that they are seen so late as that. I do not think they breed here and the late birds probably go to the Gorakhpur District. The *mir-shikars* snare them in nooses fastened on small but strong bamboo pegs which are stuck in

the ground. The nooses, which are all close together, are put down on three sides near where the bird is feeding and the men gradually make it edge up to them. If it steps into them well and good, if not they take them up and put them down further on. It is generally a very lengthy proceeding but that is immaterial to the native. Mahomedans eat its flesh. A fine male measured 60½ inches in length, had a pouch of 14″ and a wing expanse of 8′-11″. Native name *Garur*.

(281) L. JAVANICUS.—The Smaller Adjutant.

Blanford, No. 1551 ; *Hume*, No. 916.

On the 24th November I saw a pair feeding in some shallow water at Narhar. I got another one in the Darbhanga District on the 8th June 1902. I have also heard this species make the same guttural noise as *D. episcopus*. Native name *Chandiari*.

(382) PSEUDOTANTALUS LEUCOCEPHALUS.—The Painted Stork.

Blanford, No. 1552 ; *Hume*, No. 938.

I only obtained a single specimen in the sub-division but got numbers, both young and adults, brought me at Baghownie by *mir-shikars* from May to September. Native name *Kankarri*.

(283) ANASTOMUS OSCITANS.—The Open-bill.

Blanford, No. 1553; *Hume*, No. 940.

I once missed one in a tank near Jainagar in December 1896. I saw none in 1897, 1898 and 1899. One of my men came across a flock of about 125 at Minti in February 1900. I have got them from October to June but have never seen any during the other months. I do not think they breed with us. A few are in the white plumage by April but the majority seem to assume it in the following month. Native name *Dokar*.

Sub-order ARDEÆ.

Family *Ardeidæ*.

(284) ARDEA MANILLENSIS.—The Eastern Purple Heron.

Blanford, No. 1554; *Hume*, No. 924.

I have not found this species common here and have only got one adult. Some, most of them young birds, are to be seen on most of the chaurs. Native name *Khyra*.

(285) A. CINEREA.—The Common Heron.

Blanford, No. 1555; *Hume*, No. 923.

This is a common species. I have noticed them up to May but doubt whether they breed with us. I have a falcon which flies at this species and brings them down in nice style. On the ground he fastens on to the neck just below the head and the heron appears to be quite helpless. Native name *Kabud*.

(286) HERODIAS ALBA.—The Large Egret.

Blanford, No. 1559 ; *Hume*, Nos. 924 *bis* & 925.

This is the only egret I have personally seen in this district. I have always found them most wary. A very fine specimen in breeding plumage was

brought me from Fureckeer in the Monghyr District on the 11th March. It measured, *length to end of train* 47″; *wing* 17″; tail 7″·5: *tarsus* 8″·5; *bill at gape*, 6″·5; *expanse* 67″. *Bill* yellow with tip dusky; *legs and feet* black, *tibia* greenish. Three specimens all in full breeding dress had the bills yellow, though Blanford gives it as black in that plumage. Another one also in breeding plumage brought me measured, *length* 36″·5; *wing* 14″·25; tail 5″6; *tarsus* 7″; *bill at gape* 5″·5; *expanse* 54″·2. The larger ones the *mir-shikars* call *Mallang bogla* and the smaller ones *Torra bogla*. They find no difficulty in distinguishing the two varieties, but I have seen too few to form an opinion as to whether they are two species or one.

(287) H. INTERMEDIA.—The Smaller Egret.

Blanford, No. 1560; *Hume*, No. 926.

A dozen or so of this species have been brought in to me by *mir-shikars* but none in breeding plumage. Native name *Patokha bogla*.

(288) HERODIAS GARZETTA.—The Little Egret.

Blanford, No. 1561; *Hume*, No. 927.

Mr. G. Dalgliesh saw a bird of this species in full breeding plumage at Dulsing Serai in August 1900. Three or four have been brought to me by *mir-shikars*. A couple brought from Fureckeer were in breeding plumage. One a fine male measured—length 26″; *wing* 11″; *tail* 4″; *tarsus* 4″·2; *bill at gape* 4″4; *expanse* 41″. *Bill* black with base of lower mandible flesh colour tinged with green; *facial* skin greenish-yellow; *iris* yellow; *tarsus* black; *toes* dirty-yellow. The dorsal feathers of this species are most valuable. According to the *mir-shikars* they sell from Rs. 8 to Rs. 15 per tola and those of *alba* and *intermedia* from Rs. 8 to Rs. 10. Native name *Karchia bogla*.

(289) BUBULCUS COROMANDUS.—The Cattle Egret.

Blanford, No. 1562; *Hume*, No. 929.

Very common. I have found them breeding here in August. In one colony which was breeding there were quite as many birds in winter plumage as in the other dress. They assume the breeding plumage in April. Native name *Surkhia bogla*.

(290) LEPTERODIUS ASHA.—The Indian Reef-Heron.

Blanford, No. 1563; *Hume*, No. 928.

A male of this species in the dark plumage, but without the crest, was brought me to-day, the 25th March, from the Benoa Chaur. It was, according to the *mir-shikar* who brought it, the only one of its kind and was feeding with other egrets. The colours of the soft parts were:—*bill* reddish-yellow, base of maxilla brown and of lower mandible yellowish-green and flesh colour; *orbital skin* dull-green and yellow round the orbits; *iris* golden-yellow; *tibia* brown also *just below the knee* on one leg and the *greater portion of the tarsus* of the other leg of the same colour; *remainder of tarsus* of both legs yellowish-green; *toes* reddish-yellow above and dirty-yellow beneath. Native name *Kala karchia*.

(291) ARDEOLA GRAYI.—The Pond Heron.

Blanford, No. 1565; *Hume*, No. 930.

Exceedingly common. This is the well known "Paddy bird." They breed here from April to September. They commence to assume their breeding plumage in March. Native name *Bogla*.

(292) BUTORIDES JAVANICA.—The Little Green Heron.

Blanford, No. 1567; *Hume*, No. 931.

Fairly common. They breed here in May, June and July. I have never found them breeding in colonies as stated by Mr. G. Dalgliesh in the *Zoologist*. They are not so nocturnal as supposed to be, for I have very often found them on the edge of a bare tank in broad daylight. Native name *Kát bogla*.

(293) NYCTICORAX GRISEUS.—The Night Heron.

Blanford, No. 1568; *Hume*, No. 937.

Rather uncommon. I have found them at different times throughout the year. In June a few were nesting in a mango grove not far from Baghownie, but they deserted the place. Native name *Wák*.

(294) ARDETTA SINENSIS.—The Yellow Bittern.

Blanford, No. 1571; *Hume*, No. 934.

Very rare. I have only secured a single specimen which was shot in a paddy field near Jainagar in September. Mr. G. Dalgliesh got one in Dalsing Serai in December.

(295) A. CINNAMOMEA.—The Chestnut Bittern.

Blanford, No. 1572; *Hume*, No. 933.

Fairly common. I have taken a few nests in August and September. Native name *Lal bogla*.

(296) DUPETOR FLAVICOLLIS.—The Black Bittern.

Blanford, No. 1573; *Hume*, No. 932.

Very rare. I have never seen this species in the sub-division and only secured a pair on the 24th May at Baghownie. They were on the edge of a tank in the Factory. In their stomachs were the remains of shell and other fish and water insects. Mr. G. Dalgliesh got a pair at Bunhar Factory in February.

(297) BOTAURUS STELLARIS.—The Bittern.

Blanford, No. 1574; *Hume*, No. 936.

I have also found this species scarce. One or two have been shot here and about half a dozen brought in by *mir-shikars*. They are cold-weather visitants. The latest date on which one was got was the 29th March. Mr. G. Dalgliesh also shot a pair of this species. Native name *Moon*.

(*To be continued.*)

THE FERNS OF NORTH-WESTERN INDIA.

Including AFGHANISTAN, the TRANS-INDUS PROTECTED STATES, and KASHMIR: arranged and named on the basis of Hooker and Baker's *Synopsis Filicum*, and other works, with New Species added.

BY C. W. HOPE.

(*Continued from page* 749, *Vol.* XIV.)

PART III.—THE GENERAL LIST—(*continued*).

Genus 26.—POLYPODIUM, *L.*

Subgenus PHEGOPTERIS, *Fée.*

1. **P. erubescens**, Wall. ; Syn. Fil. 306 ; C. R. 543. *Phegopteris erubescens*, Wall. (under *Polypodium*), Bedd. H. B. 289.

KASHMIR : Basaoli, 5500', Clarke 1876 ; MacLeod 1891 : " mouth of gorge near 30th milestone, in very wet soil, 6-8000'."

PUNJAB : *Hazara Dist.*—Siran Range, coll. Inayat, Sahar. Herb. collr. 1899 ; *Chamba* State, McDonell, J. Marten 1898, *Kullu*—6-8000', Coventry 1894 ; *Simla Reg.*—Edgeworth, Bates : near Simla 5-6000', and Mashobra 7-8000', Blanford : " at the bottom of some of the deep valleys below Simla, where it is pretty common. My highest elevation is about 5500' " ; Sirmur, T. Thomson.

N.-W. P. : *D. D. Dist.*—Jaunsar 4500', C. G. Rogers ; Mussooree 4-6000', by water, not uncommon ; *T. Garh.*—Phedi 4-5000', and below Laluri 3-4000', Duthie ; *B. Garh.*—Mrs. Fisher ; *Kumaun*—R. B. 1827, Wallich type specimen ; Ramganga R. and Karim 6200', S. and W. 1848 ; Naini Tal 55-6000', Hope 1861 ; Davidson, Trotter ; ridge above Bageswar 6000', MacLeod 1893.

DISTRIB.—*Asia* : N. Ind. (Him.), Nepál, *Wallich* Sikkim ; Assam—Khasia 3-7000', " somewhat rare." Malay Penins. and Isles. China—Yunnan, *Delavay* 1886.

Lowest pair of pinnæ deflexed. Stipes and rhachises not always pink : sometimes pale-yellow or straw-coloured. Grows in wet ground below springs, or by the sides of streams—the fronds bending over the water, and attains a large size, 10 ft. long, including the long stipes—if my memory serves me rightly as to Naini Tal specimens. A Chamba specimen has pinnæ 13½ in. l. by 1⅛ br. It grows 8 ft. high in Mussooree.

2. **P. auriculatum**, Wall. ; Syn. Fil. 306 ; C. R. 543. *Phegopteris auriculata*, Wall. (under *Polypodium*), Bedd. H. B. 290.

PUNJAB : *Chamba State*—McDonell ; *Simla Reg.*—Edgeworth ; near Koti 6000', Gamble 1878 ; Sámal Vy. (below Simla) 4500', Blanford : " very rare in the neighbourhood of Simla. I have met with it but once " ; Simla—several stations, 57-6000', Bliss 1890-91 and 92.

N.-W. P. : *D. D. Dist.*—Mussooree, King, in Herb. Hort. Sahar ; *B. Garh.* 4-5000', Duthie 1885 ; *Kumaun*—Naini Tal, Hope 1861 ; Goriganga Vy. 6500', MacLeod 1893, pinnæ very narrow : " grows almost in beds of streams, in dense shade."

DISTRIB.—*Asia* : N. Ind. (Him.), Nepál, *Wallich* 1821 ; Sikkim and Bhotán, 5-8000' : " plentiful about Darjeeling " ; Assam—Khasia 5000', Hook. fil. et T. Thomson. Java : *fide* Clarke. China—Yunnan, Mengtze 6000', *Henry*.

A specimen collected by Mr. Bliss at Simla is 16 in. br. with pinnæ 1½ in. wide, 1¾ in. nearest rhachis, veinlets 12—14 of a side, up to 17 in lowest segments, forked in lowest, and occasionally so in next above. In this species the sori are considerably nearer the costa than the edge.

3. **P. Phegopteris**, L. ; Syn. Fil. 308 ; C. R. 544. *Phegopteris vulgaris*, Mett., Bedd. H. B. 290.

TRANS-IND. STATES : *Dir.*—Mirga 9500′, Surg.-Lt. S. A. Harriss, 1895.

KASHMIR :—Tajwas Nála, 11-12,000′, Levinge 1872-75 ; Dr. Aitchison 86-10,000′ ; Sarpat 10,000′, MacLeod ; Gulmarg 8-9000′, Duthie.

PUNJAB : *Chamba*—Pángi 8000′, McDonell 1882 ; Upper Chenáb Vy. 8000′ (in Kashmir ?), Baden Powell 1879 ; "Chamba" J. Marten ; *Pa'ngi*—Sánch Vy. 8500′, Harsukh (Sahar. Herb. collr.) 1899 ; *Lahaul*, Dr. G. Watt.

N.-W. P : *T. Garhwal*—Banga Páni 10,000′, and Kidarkanta 10-11,000′, Duthie 1879 ; *Kumaun*—between Milain and Rilkot 10,000′, MacLeod 1893.

DISTRIB.—*Amer.* : Greenland to Alaska, Labrador, Newfoundland, and Canada ; *U. S.* : New England to Virginia and westward ; *Europe* : Iceland, Scandinavia and British Isles to Spain, N. Italy and Greece, and intervening regions; Caucasus. *Asia* : N. Ind. (Him.), Sikkim—Sundukphu 11,500′ Levinge. Siberia, Mandschuria, Kamschatka, and Japan.

4. **P. distans**, Don ; Syn. Fil. 308 ; C. R. 544. *Phegopteris distans*, Don (under *Polypodium*), Bedd. H. B. 292.

KASHMIR : ?

PUNJAB :—*Chamba* ? *Simla Region* ?

N.-W. P. : *D. D. Dist.*—Jaunsar, Chakráta 7000′, Gamble No. 22,825, 1891 ; *Kumaun*, near suspension bridge on old road to Almora, Hope 1861.

DISTRIB.—*Asia* : N. Ind. (Him.), Nepal, *Wallich*; Sikkim, *C. B. Clarke* : typical ; Assam—Khasia, *Simons*. Malay Peninsula. Java. China.

As both Clarke and Beddome say, *P. distans* has tufted stipes, and as in all Gamble's specimens from Sikkim and Chittagong—16 sheets—which are complete, the caudex is erect with tufted stipes, and as this is the character of some thirty specimens in the Calcutta Herbarium, I have separated the numerous specimens from N.-W. India, hitherto called *P. distans*, but which have a widely creeping and branching rhizome, and I give them as a new species—*P. late-repens*, next below. I am doubtful about the Kashmir specimens which I have not seen except Trotter's, which we agreed are *late-repens*, and also about McDonell's from Chamba. Gamble's, and some of Blanford's, specimens from the Simla Region have erect caudices, and so have Gamble's from Jaunsar in the Dehra Dún District. The Kumaun specimens have the caudex rather decumbent and stipes subtufted, but are otherwise the same.

Generally speaking, *P. distans* seems to be a smaller, stiffer, narrower, and less cut fern than the next, but occasionally the fronds are broad for their length. This is so with a specimen from Sikkim, coll. King, No. 4132, 1877, which Sir George kindly sent me in 1890, as a type of Don's plant. That frond is

14 inches broad. The stipes are very erect, closely set, and densely scaly for some way up. The pinnæ are cut down ¾ or 4/5ths to the rhachis, and the segments are entire, or very slightly crenate at the apex. Don's description in the Prod. Fl. Nepàl is :—

"*P. distans*, fronde lanceolatâ—pinnatâ : primus distantibus subopppositis lanceolatis acuminatis altepinnatifidis pilosiusculis ; segmentes oblongis apice rotundatis ; imis inciso-serratis ; superioribus repandis, stipite rhachique semi-territibus villosis, soris remotis biserialis.

"Hab. in Nepaliæ alpibus, Wallich. Frons bi—v. tripedalis. Rhachis purpurascens."

There is no allusion to a rhizome in the above. Mr. Duthie once kindly noted down for me the localities and collector's names of the (Indian ?) specimens named *P. distans* in the Calcutta Herbarium ; and I grouped them in five forms, thus :—(1) *Typical form*, from Simla, *Gamble* ; Sikkim, Khasia, and Nilgiris ; (2) *var. minor*, *C. B. Clarke*, from Sikkim ; (3) *var. glabrata*, *C. B. Clarke*, Kumaun, *R. Blinkworth*, without rhizome, named *P. brunneum* Wall. on original ticket : margins of segments almost entire ; (4) *var. paludosum*, from Labaul, Khasia, Nilgiris *Gamble*, and Ceylon,—rhizome erect, stipes tufted ; and (5) *var. adnata* (sp.) Wall., from Dharmsala *Edgeworth*, Chamba *C. B. Clarke*, Garhwal 8000′ *Blanford*, Nepal, Nilgiris *Beddome*, Ceylon *Thwaites*. Mr. Duthie noted that there were no type specimens of Don or Wallich, except a doubtful one of each ; and that the specimen ascribed to Don looked very different from the rest of *var. adnata*, the margins of the segments being almost entire.

5. **P. late-repens**, n. sp., (Trotter MS.) *Hope* Plate XIV. (see Vol. XII., p. 628).

Add.—for Jaunsar hab—Molta Range 6000′, Duthie 1896 ; *B. Garh.* Mrs. Fisher : pinnules entire, only toothed at points : no stipes present. *Kumaun* : Inayat, nat. collr. Sahar. Herbarium, No. 25,088, 8-1890.

6. **P. Dryopteris**, L., including *P. Robertianum* Hoffm.; Syn. Fil. 309; C. R. 545. *Phegopteris Dryopteris*, Linn. (under *Polypodium*), Bedd. H. B. 293.

AFGHAN : Kurram Vy., Aitch. 1879 ; Peiwàs Kotal, Collett 1879.

TRANS-IND. STATES : *Baraul*—Mirga 7500′, Gatacre 1895 ; *Chitral*, J. E. Younghusband 1894.

KASHMIR ; 7-13,000′, frequent ; Gilgit—Toltion Indus, 5000′, Winterbottom 1847.

PUNJAB : Hazara Dist.—Kagán Vy., Inayat (Sahar. Herb. collr.) 1896 (probably *P. Robertianum*); *Chamba State* 7-8000′, McDonell, J. Marten, 1882 to 1899; *Kangra Vy. Dist.* 8000′, Harsukh (Sahar. Herb. collr.) 1899.

N.-W. P. : *T. Garhwal*—Ganges Vy., 8-11,000′ Duthie ; *B. Garh*—Dombitia Gadh 9000′, Duthie ; *Kumaun* 10-13,000′, Duthie, Trotter, MacLeod.

DISTRIB.—*Amer.* : Greenland and Sitka to Rocky Mts., Canada and Newfoundland ; *U.S.* : N. E. States to Virginia, and westward to Oregon and Alaska. *Europe* : Widely distributed, from the extreme north to Italy and south of Spain. *Asia* : Seberia and Kamschatka. China—Peking Mts. 5000′, *Hancock* : "very rare"; Mukden—Kirin, *James*.

I have marked some of the specimens enumerated above *P. Dryopteris*, and others *P. Robertianum*, but there are others I am not sure about. I think the difference between the two plants is not so great as it is in Great Britain. I agree with Mr. Clarke that if *P. Robertianum* is distinct it grows in the N.-W. Himalaya.

7. **P. ornatum**, Wall. Cat. 327 ; C. R. 545. *Phegopteris ornata*, Wall. (under *Polypodium*), Bedd. F. S. I., t. 171, H. B. 294.

N.-W. P. :—*Kumaun* : *fide* Clarke in 'Review.'

DISTRIB.—*Asia* : N. Ind. (Him.), Sikkim and Bhotán, in tropical valleys 0-2000′, common ; Bengal—Chittagong Hills 500′, S. Ind.—Carcoor Ghâts, Malabar, and elsewhere along the Western Ghats, but not common—*de* Beddome. Ceylon. Malaya. N. Australia. Polynesia.

I enter this species on Mr. Clarke's authority, but I do not think it can be common in Kumaun, as he seems to say, for none of my correspondents seem to have found it there. I have not myself collected in the low-lying valleys of Kumaun, except in that of the Gola, from about 2000′ upwards, and I did not see it there.

8. **P. punctatum.** Thunb. ; Syn. Fil. 312. *P. rugosulum*, Labill., C. R. 546. *Phegopteris punctata* Thunb. (under *Polypodium*), Bedd. H. B. 295.

PUNJAB : *Chamba*, McDonell, J. Marten ; *Kulln*—Trotter, in List ; *Simla Reg.* : Asan Valley, Edgeworth 1840 ; seen, freshly gathered, by Hope, 1886—said to be from Rifle Range, E. of Jako Mt. 6-7000′ : not in Blanford's List and not got by Bliss.

N.-W. P. : *D. D. Dist.*—Jaunsar, Lakhwa 3-4000′, Gammie ; Chatra 6000′, Gamble ; *T. Garh.* 4-5000′, Herschel, Mackinnons, Hope, Duthie ; *Kumaun* T. T. 1845, S. and W. 5-7000′, Duthie, Trotter, MacLeod.

DISTRIB.—*Amer.* : Columbia to Chili. *Asia* : N. Ind. (Him.), Nepal *Wallich* ; Sikkim and Bhotan ; Assam—Mishmi *Griffith*, Khasia *T. Lobb*. Bengal—Chittagong, alt. 1000′—5000′. S. Ind., common on W. Mts. at high alts. Ceylon, Malay Penins. Tonkin. Java. Philippines. Japan. Sandwich Isles. N. Caledonia. Moluccas. Australia. N. Zealand. Van Dieman's Land. *Afr.* : Fernando Po 7000′. Tristan da Cunha St. Helena. Bourbon. Madagascar.

Subgenus GONIOPTERIS, *Presl.*

9. **P. urophyllum**, Wall. Cat. 299 ; Syn. Fil. 314 ; C. R. 547. *Nephrodium urophyllum*, Wall. (under *Polypodium*), Bedd. H. B. 274 and Suppt. 72.

N.-W. P. : *Garhwal* and *Kumaun*, *fide* Clarke in 'Review.'

DISTRIB.—*Asia* : N. Ind. (Him.), Sikkim and Bhotan ; Assam—Khasia ; Bengal—Chittagong. Burma. Ceylon. Malaya. New Hebrides—Aneiteum. *China* : Chusan. Polynesia. N. Australia. Queensland.

I have not seen the specimens from the west of Nepal on which Clarke founds, nor any others from N.-W. India.

10. **P. proliferum**, Presl.; Syn. Fil. 315. *P. proliferum* (Roxb.) Wall. Cat. 312, C. R. 548. *Goniopteris prolifera* Roxb., Bedd. H. B. 296. *Meniscium proliferum* (*Sw.*) *Hook* 2nd Cent.

KASHMIR : 3000'; Trotter in List.

PUNJAB : *Chamba*—McDonell in List; near Dalhousie 3000', Trotter, *Kangra Valley Dist.* 2-3000', Trotter.

N.-W. P.: *D. D. Dist.*—Very common in the Dún, on banks of streams and canals, up to perhaps 3000'; *T. Garh.* 1500', *Hope*, 3000' Mackinnons; *Saharanpur Dist.*—Roorkee, Lt. Sedgwick, R.E.; *Kumaun*—The Bhabar 1000', S. and W.; Gonai, Davidson, above Katgodam—below 2000', Hope; *Gorakhpur Dist.*—Sirna Tal, on banks of Rohni R: had been submerged 11ft. by a flood, A. Campbell; Moradabad, T. T. 1844; North Oudh Forests, R. Thompson.

DISTRIB.—*Asia*: N. Ind.—eastward in the plains, and westward along the foot of the hills up to 3000'; Chutia Nagpur, *Rev. A. Campbell*; Central Provs., Hoshangabad Dist., *Duthie*; The Concan, *Law.* S. Ind.; Ceylon—Trincomalee, *Wight*; Burma—Mergui. Malaya S. China. Philippines. N. Caledonia. N. Australia. S. Australia—Queensland. New Guinea. *Afr*: Angola. Zambesi Land. Shire—near Blantyre; E. Trop. Africa. Mauritius. S. Africa.

As I find none of the published descriptions of this species sufficient, I venture the following, which is founded on long observation of growing plants :—

Rhizome stout, slowly creeping and branching. *Fronds* springing sometimes in tufts, procumbent, or climbing among bushes and in hedgerows : sometimes of definite length, broad, spreading, and sterile, but one or more fronds of a tuft having a leading prolonged rhachis which throws off branches from buds at the axils of the pinnae 3-6 inches apart, up to 6 branches per bud, and, if trailing on the ground, becomes an epigeous rhizome, throwing out roots as well as branches from the axils, but ultimately diminishes in width and becomes flagelliform : the side branches fertile, and often prolonged, sending out one or more branches from each bud as does the main rhachis : the main flagelliform rhachis often fertile to the apex. (*Quoad ultra— vide auctores*).

Some of my observations were made on plants naturalised in my garden in Dehra (N.-W. P.), transplants from a closely adjoining natural station. Given moisture and other favourable circumstances, this species is capable of great development : I believe lateral shoots sometimes become leaders. Beddome is certainly wrong in saying that the elongated and flagelliform fronds are "non-seeding," as specimens in my collection show.

11. **P. lineatum**, Colebr. in Wall. Cat. 300; Syn. Fil. 316; C. R. 548. *Nephrodium costatum*, Wall. (under *Polypodium*), Bedd. H. B. 275 and Suppt. 73.

KASHMIR: Tawi Vy. 4000', Levinge 1875; Trotter, in MS. List; Jhelam Vy. "35th Milestone," MacLeod 1891.

PUNJAB: *Chamba State*—McDonell in List; Chamba 5000', Blanford, Trotter; *Simla Reg.*—Simla 5500', Bates, Gamble, Bliss; Sirmur—T. T.

N.-W. P.: "N. W. I.", very red, Falconer; *D. D. Dist.*—Mussooree 4-6000' by streams and in swampy ground, not uncommon, Herb. Dalzel, King, Mackinnons, Duthie, Hope; *T. Garh*—Mackinnons, Duthie 4-5000'; *B. Garh.*—Mrs. Fisher; *Kumaun*—Wallich; Pburka and Bagesar 3500', S. and W. 1848; Col. Davidson 1875 (very red); Nalena Vy. 47-5000', Hope 1890 (only slightly red); near Bagesar 3000', Trotter 1891.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál, *Wallich* 1827; Assam—Mishi, *Griffith*, Khasia. Silhet. Ceylon. Penang. China-Centr., *Mr. Maries*; Ichang, *Henry*; *Szechwan*: Mt. Omei, *Faber*; *Yunnan*: Mengtze, *Hancock*.

A very different looking plant from the next, and much more elegant. The rhizome is widely creeping, never erect. By the side of running water it grows to a large size. I have a frond I gathered in Kumaun, mounted on five 18½" sheets, with stipes almost 30 in. and frond 57 in. l., and I got others larger. Mr. J. W. Furrell has seen fronds, 8 ft. long, without stipe. As is often the case with ferns having a creeping rhizome, many fronds are sterile, but otherwise the same as the fertile fronds. I have never seen any trace of involucre on even very young fronds gathered in N.-W. India. Beddome says specimens from Dr. Stuart, Garhwál, have the involucre very distinct. Clarke, who kept the species in *Polypodium* (*Goniopteris*), says the young sori have many hairs among them.

The stipes, rhachises and veins are often quite red. The number of veins runs up to 10 pairs, the excurrent venule being often free. Beddome, in his supplement, says the rhizome is sometimes creeping, sometimes erect. I find it is always widely creeping. Beddome may have mixed up two distinct ferns; and I cannot admit that a fern can be so inconsistent in its structure and habit as he says this is.

12. **P. multilineatum**, Wall.; Syn. Fil. 316; C. R. 547. *Nephrodium moulmeinense*, Bedd. H. B. 275, F. B. I., t. 231.

KASHMIR: Poonch 3000', Major Sage: *fide* Trotter in printed List.

N. W. P.: *D. D. Dist.*—in the Dún, Nalota Khála about 2500', Hope 1880-87-89; Ramgarh Road 2000', Gamble 1892; below Mussooree, to westward, 4000', Mackinnons 1878; Birání Nadi, Duthie 1882; B. Garhwál, Mrs. Fisher; *Kumaun*, Almora, Davidson 1875; Kali Vy. 2-3000', Duthie 1884; Gola Vy. 2500', Hope 1890; Sarju Vy., near Bagesar, 3000' S. and W.; 3-3500', Trotter 1891. *North Oudh* Forests, R. Thompson.

DISTRIB.—*Asia* : N. Ind. (Him.), Sikkim and Bhotàn ; *Bengal* : Chittagong and plain westward, and ascending the Himalaya to 4-5000′, Parasnàth Mt. *Rev. A. Campbell* ; Assam—*Wallich* 1829 ; all over the Province ; Nambur Forest, *Mann. S. Ind.* : Golconda Hills, west of Vizagapatam, 2-3000′, " involucre distinct " ; not on Western Mts., *Beddome* in H. B. *Burma* : " very common near Moulmein, involucre distinct ", *Beddome*. Fiji Isles, Seeman ?

Under *P. lineatum*, Baker remarks—" Seems not distinct from the next, "—but see my remark above as to the contrast between the two. The present plant is more coriaceous, and very dry-looking, with veins very prominent and distinct : the fronds are generally broader and shorter, and have fewer pinnæ than *P. lineatum* has,—4-15 pairs in Gamble's and my specimens ; whereas in our *P. lineatum* the number varies from 8 to 30 pairs, only 3 specimens having less than 16 pairs. A specimen I have, from Parasnàth Mt. in Bengal, is 7′-6½″ high from the rhizome, of which total the stipe is 44½ inches, and the frond 46. It has only 14 pairs of pinnæ : the lowest are 10 in. l., the next pair 12″, and above that there are several about 13 in. The width of the broadest is barely above 1½ in. The pinnæ of *P. multilineatum* are much the broader, and the number of pairs of veins runs up to 23 and even 25. Trotter's plant from Kumaun has the narrowest pinnæ of any I have seen—⅞ in., but it nevertheless has 16 pairs of veins. My Kumaun specimens were growing in a swampy slope in forest : very few fronds were fertile. As Beddome added in his supplement, the rhizome is creeping : the stipes are distinct.

Blanford, in his published List, gives Simla as a habitat, saying :—" ' The Glen' and some other wooded ravines below 6000′. The pinnæ are narrow." I think this must be *P. lineatum* Colebr. His specimen of *P. lineatum* from Chamba is marked by him *P. multilineatum*, and yet has the narrowest pinnæ of any *lineatum*, I have seen, with only 6-7 pairs of veins. Trotter says he collected *P. multilineatum* in Chamba and Simla ; and if he is right as to Major Sage's specimen from Kashmir this is probable enough ; but the evidence I have seems insufficient.

I have never seen the slightest trace of involucre in this fern, as growing in N.-W. India ; but I detected some in Gamble's specimens from the Palkonda Hills in the Vizagapatam District, 2500′, and the Rumpa Hills, 2000′, in the Godavery District, Madras Presidency. The Rumpa Hills plant has pinnæ cut down about ⅓ of the half width (½ in terminal pinnæ), segments wider than in other *P. multilineatum*, and not more than 13 pairs of veins, which curve upwards ; and the sori are at a distance from the costa instead of near it ; they are much nearer the excurrent veinlet. These Madras specimens may be the same as the Moulmein plant, which I have not seen ; and I suspect Beddome may be right in setting up *N. moulmeinense*, but wrong in upsetting *P. multilineatum*. In his supplement of 1892 he says that fronds of *N. moul-*

meinense lately received in a very young state show ciliated involucres on almost all the sori; and that Mr. Mann's specimens from the Nambur Forest, Assam, have the pinnæ 2¼ inches broad. 1⅝ in. is, I think, the broadest I have of *P. multilineatum*.

Subgenus EUPOLYPODIUM.

13. **P. subfalcatum**, Bl.; Syn. Fil. 328; C. R. 449, Bedd. H.B. 314.

N.-W. P.—*B. Garh.*, Mackinnons 1882; *Kumaun*—Kalimundi 8500′, S. and W., No. 19; *P.* part of Wall. 310; named *P. subfalcatum* by Sir W. J. Hooker. Above Gini 6-7000′, near Sosa 9-10,000′, Duthie 1884. North India, Edgeworth, *fide* Hooker.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál, *Wallich*, Central Nepál, *J. Scully* 1880. Sikkim and Bhotán, common; Assam—Khasia 4-5000′, frequent. S. Ind.—Nilgiris and Anamallays 4-5000′. Ceylon—Centr. Prov. Malay Penins. 3-4000′, and Isles. Philippines, *Cuming*; Borneo; Moluccas—Batjan Isd.; New Guinea, *Beccariect.*

Subgenus GONIOPHLEBIUM, Bl.

14. **P. amœnum**, Wall.; Syn. Fil. 341; C. R. 550. *Goniophlebium amœnum*, Wall. (under *Polypodium*), Bedd. H. B. 317.

PUNJAB: *Chamba*, McDonell; 5-8000′, J. Marten 1897; *Kangra Vy. Dist.* 8000′; *Kullu* 6-8000′, Trotter, Coventry; *Simla Reg.*—Simla and neighbourhood, and eastward along Thibet Road to Bisahir, 6-9500′, T. T., Edgeworth, Bates, Hope, Gamble, Blanf, Trotter, Bliss, Lace; Sirmur, T. T.

N.-W. P.: *D. D. Dist.*—Jaunsar, Dakera 5500′, C.G. Rogers, Harianta 8500′, Gamble 1898; Mussooree—'The Park' Hope; Landour—Seal's Hill 7000′, Hope; *T. Garh.* Nág Tiba Mt. 9000′, Mackinnons; Ganges Vy. 7-8000′, Duthie, Datuni 7000′, Gamble; "Garhwál," Griffith 1845; *B. Garh.*, Mrs. Fisher; *Kumaun*—Kathi 7500′, Jagesar 6000′, S. & W., near Naini Tál 5500′ Hope; above Ramgarh 7000′, Trotter; Kála Muni Ridge 9500′, MacLeod.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál, *Wallich*; Sikkim and Bhotán; Assam—Khasia Dist. 3-6000′, very common; Manipur *G. Watt.* China, *Henry*, *Hancock*; Formosa (doubted by Clarke). Tonkin, *Balansa.*

Mr. Clarke can distinguish this fern from some large specimens of *P. lachnopus* Wall. (No. 15 below) only by the scales (on rhizome ?) not being hair-pointed: he says there is no difference between the two, and he has *P. lachnopus* exceedingly large. One does not need to look at the scales to distinguish between the two species. *P. amœnum* has a broadly lanceolate frond—twice to thrice, rarely more—as long as it is broad: *P. lachnopus* is linear-lanceolate, commonly six to seven times as long as broad, and rarely is the breadth so much as one-fifth of the length: 15in. l. by 2in. broad are common dimensions, and I have a frond 21 in. by 3 in. The number of pinnæ (or lobes) in the two species is considerably different: in *amœnum* it is sometimes less than 20, generally 25-30, and very rarely reaching 25-40: in *lachnopus* the number is rarely below 30, and frequently reaches 45 or more. In *amœnum* the costæ of the segments are from ⅝ in. to 1¼ in. apart, and the segments gradually taper from a broad base to a generally very fine point: in *lachnopus* the costæ are generally

about 3/8 to 7/16 in. apart, rarely ½ in. or over, and the segments suddenly taper at about two-thirds of their length. The fronds of *lachnopus* are much weaker and thinner than those of *amœnum*, and they hang perpendicularly from the trees they grow on. I have rarely seen *P. lachnopus* on rocks. *P. amœnum* generally, I think, grows on rocks, or in soil on rocky slopes, sometimes standing upright ; but in Mussooree I have seen it on trees. When in a young state the fronds are very pubescent, and always there are numerous small chaffy scales on and near the rhachis on the under side. The fronds of *P. lachnopus* are all but naked.

15. **P. lachnopus**, Wall.; Syn. Fil. 342 ; C. R. 551. *Goniophlebium lachnopus*, Wall., Bedd. H. B. 319.

KASHMIR : *fide* Clarke, in 'Review.'

PUNJAB : *Kullu* 5-7000', Trotter in printed List ; *Simla Region*—Simla, Edgeworth 5-5500', Gamble, Blanford, Trotter, "not very common" ; Mashobra, Bliss.

N.-W. P. : *D. D. Dist.*—in the Dún : Nalota Khála 2600', Hope ; Mussooree 55-6500', in many places, on trees, Duthie, Mackinnons, Hope ; *T. Garh.*—Jumna Vy. 6-7000', Duthie, Sahlra Vy. 6000', Gamble ; *Kumaun*—R. Bl. ; Mohargiri 6500', S. and W. 1848 ; Hawalbágh ; Naini Tál, S. and W., Hope, Davidson ; near Askot 4-5000', Duthie ; Nalena Vy. 47-5000', on rocks, Hope ; Sarju Vy., Bansi 5500' Trotter ; Goriganga Vy. 8500', Kála Muni Ridge 8500', MacLeod.

DISTRIB.—*Asia* : N. E. Ind. (Him.) Nepál ; *Wallich* 1821 ; Sikkim and Bhotán ; Assam—Khasia Dist. 3-5000', "very common," *Clarke* ; N. Manipur 5500', *Clarke*.

See my remarks under *P. amœnum*, Wall., No. 14, above. Occasionally, when growing in an exposed dry situation I suppose, this fern is very small and wiry : Duthie's example from the Jumna Valley has fronds only 4″×1¼″ l. including stipes. MacLeod's, from the Kála Muni Ridge, Kumaun, is from 6 to 11 in. including stipes. I watched this fern at Mussooree for a number of years, and I believed it was spreading there. It is a striking object, hanging from the large oak trees in the forest, on the north side of the ridge, up to 6500′ alt., and I could easily distinguish it from *P. microrhizoma*, Clarke (which is much more common) at some distance. The elevation—"up to 11,000′"—given in the *Synopsis*, seems much too high, and Clarke's higher limit, 6000′, is too low ; but Beddome has cut that down to 3000′, on what authority I know not. Blanford says—"Not very common at Simla. Found on trees and rocks in shady ravines below 6000′."

16. **P. microrrhizoma**, C. B. Clarke, in Trans. Linn. *Soc.*, 2d. Ser. Bot., Vol. I, 1880, p. 551 (C. R.) ; Syn. Fil., 2d. Ed., 511. *Goniophlebium microrrhizoma*, Clarke, Bedd. H. B. 322.

KASHMIR.—*fide* Clarke ; Trotter in Lists.

PUNJAB : *Chamba*—McDonell in List ; J. Marten 5-7000', 1897 ; *Mandi State* 5000', Trotter ; *Kangra Vy. Dist.* Dalhousie, Clarke ; *Kullu* 7-9000', Trotter ; *Simla Reg.*—Simla, and eastward along ridge to Matiána 6-9000′ : "very common on rocks and trees from 5500′ to 8500′" (Blanford in List).

N.-W. P.: *D. D. Dist.*—Mussooree and Landour 6-7500′, everywhere, on rocks and trees; *B. Garh.*, Mrs. Fisher; *Kumaun*—Jagesar 6000′, S. and W.; Naini Tál; Kali Vy. 9-10,000′, Duthie; Goriganga Valley 7000′, MacLeod.

DISTRIB.—*Asia*: N. Ind. (Him.) Sikkim and Bhotan; Assam—Jakpho Mt. 9000′, *Clarke*: China—Yunnan, *Delavay*, *Henry*.

Besides the difference in the scales of rhizome between this species and *P. lachnopus*, distinguishing characters of *microrrhizoma* not mentioned by Mr. Clarke are—the brown stipes, and darker brown rhachis; the broader, shorter, and rather stouter frond; pinnæ much fewer—generally only 15-25 pairs—and broader; and sori often oblong or oval. At Mussooree this fern grows to a higher level than *P. lachnopus*. The rhizome does not strike me as being very small.

17. **P. argutum**, Wall.; Syn. Fil. 511; C. R. 551. *Goniophlebium argutum*, Wall. (under *Polypodium*), Bedd. H. B. 323.

N.-W. P.: *D. D. Dist.*—Mussooree 6500′, Hope 1885; *T. Garh.*—Nág Tiba Mt. 8000′ Mackinnons 8000′; *B. Garh.* 6-7000′, Duthie 1885, Mrs. Fisher; *Kumaun*, R. Bl.; Binsar, on trees, 7000′, S. and W. 1848, and Major Madden; Naini Tál 5-8000′, on trees, Hope 1861, Davidson 1875; between Gini and Munshiari 7-8000′, above Gini 6-7000′, and Gori Vy. 7-8000′, Duthie 1884; above Lonarkhet 7500′, Trotter 1891; Ránti and Kála Muni Ridge 7-10,000′, MacLeod 1893.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál, *Wallich* 1829; Sikkim and Bhotán, 4-9000′, very common; Assam—Khasia.

Mr. Clarke gives—"Himalaya, from Kashmir to Bhotán, very common" as habitats for this species, but I cannot find any specimens from the westward of Tehri Garhwal in the N.-W. Provinces, nor did Mr. Trotter; and Mr. Blanford is silent as to the Simla Region. The Jaunsar Tract of the Dehra Dún District also seems a blank.

My plant from Mussooree is from the only known station in, or within, two days' journey of that place: it must be 10 or 15 miles from Nág Tiba Mt. in a straight line across the deep valley of the Aglar River. I found the fern in Mussooree on one branch of one Rhododendron (*arboreum*) tree only, and left most of the rhizome and fronds on it, and it was still there in 1895, but did not appear to have spread to other trees. *P. argutum* was pretty common in Naini Tál in 1861, on the Sher-ka-danda side of the Lake, high up.

Subgenus NIPHOBOLUS, *Auct.*

19. **P. adnascens**, Sw.; Syn. Fil. 349; C. R. 552. *Niphobolus adnascens*, Sw. (under *Polypodium*), Bedd. H. B. 324.

N.-W. P.: *B. Garh.* 3-4000′, P. W. Mackinnon 1881; *Kumaun*—Ramganga R. 2500. S. and W.; 4-5000′ and 3-4000′, Duthie 1884; Sarju Vy. 3500′, Trotter 1891; "Goriganga Valley and elsewhere," 5-8000′, MacLeod 1893.

DISTRIB.—*Asia*: "Throughout N. India in moist climates," *Clarke*. Himalaya—up to 5000′ and even 8000′: "extending over the plains to Calcutta and the sea-face of the Soonderbun"; Assam—Kachar, Mishmi *Griffith*, Manipur, *Watt*. S. Ind., Burma—

Mergui, *Griffith*, Andaman Islands. Ceylon. Malaya. Tonkin. China—Yunnan. Chusan. Fiji. New Hebrides,—Aneiteum N. Australia—Cape York. *Afr.*: Camerun Mts. Eritrea, G. Schweinfurth, 1896 ? Mascaren Isles.

New to N.-W. India ; and there not found westward of the Ganges.

20. **P. stigmosum**, Sw.; Syn. Fil. 350 ; C. R. 553. *Niphobolus stigmosus* Sw., Bedd. H. B. 328.

N.-W. P.: *T. Garhwal*—4000', Mackinnons 1878 ; below Laluri 3-4000', Duthie 1881 ; *Kumaun*—Sarju Vy.—Gangoli Hát 3000', Major Madden ; Káli Vy. 2-3000', Duthie 1884 ; Gola Valley 2300', Hope 1890 ; Sarju Vy.—Bageswar, T. T., 3000' S. and W., Trotter 1891; Sarju and Goriganga Valleys 3-5000', MacLeod 1893.

DISTRIB.—*Asia* : N. Ind. (Him-) Sikkim and Bhotán 1-4-5000', Assam—Khasia 2-3000' very common ; W. Manipur 3500', *Clarke* ; Bengal—Chutia Nagpur, Parasnáth Mt. 2500', *Clarke*. S. Ind.—Golconda Mts. Burma—Tenasserim. Sumatra, *Hancock*. China—Yunnan, *Henry*, *Hancock*.

21. **P. fissum**, Baker ; Syn. Fil. 351 ; C. R. 554. *Niphobolus fissus*, Bl., Bedd. H. B. 330.

KASHMIR : *fide* Clarke in 'Review', and Trotter in Lists.

PUNJAB : *Chamba*—Ravi Vy. 6000', McDonell ; 5500', J. Marten 1897 ; *Kullu*—Upper Bias Vy. 5-6000', Trotter ; *Simla Reg.*, Blanford : "rare, and found only at levels below 5500'" ; below Simla 5500', Hope ; Simla—"The Glen" and road to it, Jaru-ka—Nál, Bliss 1890-92.

N.-W. P. : *D. D. Dist.*—Jaunsar, Duthie 1879, Lokár, Gamble ; "Jaunsar," C. G. Rogers ; Molta Forest, 5000', Gamble ; *T. Garh*, 5-8000', Gamble, Mackinnons ; *B. Garh*, Mrs. Fisher ; *Kumaun*—near Bagesar 3000', Vy. of Sarju 3500', native collector, in Herb. Hort. Saharanpur ; Gola Vy. 23-4000', very abundant, on rocks and trees, Hope ; Naini Tál and elsewhere 5-6500', Hope, Duthie ; near Almora 5000' MacLeod.

DISTRIB.—*Asia* : N. Ind. (Him.) eastward to Bhotan, very common ; Assam—Khasia 1000'-5000', very common ; Manipur, *Watt*. S. Ind.—W. Mts. 2-3000'. Burma—The Shán Hills, *Collett* ; Ceylon—C. Prov. Malay Penins. Java. Philippines. China. *Afr.* : E. Trop. Zambesi Highlands. Madagascar.

22. **P. flocculosum**, Don ; Syn. Fil. 351 ; C. R. 554. *Niphobolus flocculosus*, Don, Bedd. H. B. 331.

PUNJAB : *Kangra Vy. Dist.*—Dharmsala 6000', Trotter 1887 ; Simla—Edgew., and Madden, *fide* Sir J. W. Hook.

N.-W. P. : *D. D. Dist.*—from 2600' to 5000' : common from south of Debra, in Debra, northward to Rajpur, and to above Jhari Páni on road to Mussooree, on trees ; *Kumaun*—3000'-6000', very common.

DISTRIB.—*Asia* : N. Ind. (Him.) Sikkim and Bhotán, rare ; Assam—Khasia, up to 4000', and Sylhet Plain.

The description of the shape of the frond in the '*Synopsis*'—"narrowed very gradually to both ends"—is wrong, and subsequent writers have not put it right. Clarke says—"Suddenly or gradually narrowed at base," and Beddome—"lanceolate, finely acuminate, sub-sinuate, moderately attenuated and decurrent, or broad and unequally hastate at the base." The frond is never

gradually narrowed to both ends—so far as I can see. It is gradually narrowed to the apex, but always more or less suddenly to the base. Only occasionally it seems to be narrowed to the base equally on both sides; but that sometimes is because one side has been folded up in pressing, or when the shoulders are narrower than usual. I should describe the frond as—lanceolate acuminate, one half ending at the base before the other, both halves decurrent on the stipes. It is as if two longitudinal halves of lance heads, of unequal length, were joined together so that the points coincided. The shorter side is sometimes more suddenly narrowed than the other. In the same plant some of the fronds will have the shorter half of the lance head on one side, and others on the other—according as, I think, they have sprung from one or other side of the rhizome. Specimens with fronds narrowed at both ends are probably *P. fissum*, which have got mixed. The latter-mentioned species has sometimes rather broad fronds, and it too sometimes narrows below rather unequally; but it has hardly any stipes, whereas *P. flocculosum* has a stipe of one-third or more the length of the frond.

P. flocculosum is very common in Dehra, and along the road and canal avenues up to Rajpur at the foot of the Himalaya, alt. 2100-3000′, chiefly on Mango trees, which have rough bark; but since I first observed it in 1879-80 it seems to have spread also to Toon trees (*Cedrela toona*), the bark of which is much smoother. Above Rajpur, up to about 5000′, it grows in the forest on various kinds of trees, *Bauhinia* and others. It is also very abundant in the forest in the Gola Valley, below Naini Tál, up to 5000′ or higher, on rocks as well as on trees. This plant does not shed its fronds annually: they are persistent for a time, shrivelling up at the close of the rains, or during a prolonged break in them, and uncurling and appearing quite fresh after a good fall of rain in the dry season, or at the setting in of the next season's rains—quite hygroscopic in fact. This may be a character of all the species of *Niphobolus*, as it is of certain species of some other genera and subgenera—see *Asplenium exiguum* above, and *Polypodium* (*Phym.*) *lineare* below. Plants of *P. flocculosum* may be taken from a tree in the cold, or dry hot, season, soaked in water till they uncurl, and be then made good specimens of, though of course without young fronds. Mr. Trotter took some plants from Dehra to Rawalpindi, and so treated them, and laid them into his herbarium. The rhizome is slow growing and never found of any considerable length, and it throws up only a few fronds each year, in a tuft. The fronds probably live on until the rhizome dies off at the back end.

Subgenus DRYNARIA, *Bory.*

28. **P. propinquum**, Wall., Syn. Fil. 367; C. B. 556. *Drynaria propinqua*, Wall., Bedd. H. B. 339.

N.-W. P.: *T. Garh.*—in Herb. Hort. Saharanpur: marked "Kidarkanta, 5", on ticket: no collector's name. *B. Garh*—6000', Mackinnons 1881; Kinoli Vy., Duthie 1885; Mrs. Fisher; *Kumaun*—Ramari 4500', Binsar 7000', S. & W.; Alaknanda Valley, near Joshimáth, Edgew.; Mymunda, Davidson 1875; Gori Vy. 5-6000', Duthie 1884; Nalena Vy. 47-5000', Hope 1880; near Pitoragarh 6500', Trotter 1891; Sarjuganga Vy. and elsewhere 4-7000', MacLeod 1893.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál, *Wallich*; Sikkim and Bhotán, "very common," *Clarke*; Assam—Khasia Dist. 2-5000', very common, Kohima 6000', *Clarke*. Burma. Malay Penins. Java. China—Scechwán, on Mt. Omei, *Faber*; Yunnan, *Delavay, Hancock, Henry*. *Afr.*: W. Islands.

24. **P. rivale**, Mett. MSS.; Syn. Fil. 367; C. R. 556. *Drynaria mollis*, Bedd. H. B. 341.

PUNJAB: *Chamba*, MacDonell; *Kullu* 8-900', Trotter; *Simla Reg.*—Simla and eastward to Hattu Mt. 7-9500', on oak trees: locally abundant.

N.-W. P.: *D. D. Dist.*—Jaunsar, Deoban 9000', Herschel and Duthie's collr. 1875; Landour 7100', Hope; Garhwal 8-9000'; Lev., *T. Garh.*—Nag Tiba Mt. 9000 Mackinnons; Jumna and Ganges Valleys 8-10,000' and 5-6000', Duthie; *B. Garh.*, Mrs. Fisher, *Kumaun*—Binsar 7000', S. & W.; Naini Tál and near it, Hope, Trotter; Goriganga Vy. 8700', MacLeod 1893: "Grows in enormous tufts, built up of old stems."

DISTRIB.—*Asia*: Thibet—Soulié, *Hobson*. N. Ind. (Him.) Chumbi Vy., in Thibet, on south slope of Himalaya, King's collector, 1882. China—N. Shen-Si Prov. *Revd. J. Giraldi* (P. Baronii, n. sp., *Christ*).

The '*Synopsis*' gives N.-E. Himalaya as the habitat; but this seems a misprint for N.-W. Him., as the Chumbi Station—between Sikkim and Bhotán—was not then known. Also, in the "*Synopsis*" it is said that the venation is like that of *Goniophlebium*; but Mr. Clarke says it is that of other *Drynarias*. Colonel Beddome gives an exact description of the fern.

Subgenus PHYMATODES, *Presl.*

25. **P. lineare**, Thumb; Syn. Fil. 354; C. R. 558. *Pleopeltis linearis*, Thunb.; Bedd. H. B. 346.

KASHMIR:—*fide* Clarke in 'Review.'

PUNJAB: Hazára Dist.—Kagán Vy. 14,400', Inayat (collector for Herb. Sahar.) 1896; *Chamba*, McDonell; Mandi State and Kullu, Trotter in List; *Simla Reg.*—5-8000', common.

N.-W. P.: *D. D. Dist.*—In the Dún 2-3000', common; Mussooree 55-6500', in many places; *T. Garh.*—Phedi 4-5000' Duthie; *B. Garh.* Mrs. Fisher; *Kumaun*—2-9000', common.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepal, *Winterbottom*; Sikkim and Bhotán; Assam—Khasia Dist. 500'-6000', "very common," W. Manipur 3000', *Clarke*. S. Ind.—throughout, *Beddome*. Ceylon. Malayan Penins., and Isles. China. Japan. *Afr.*: S. & Centr., with the Islands.

Blanford says:—"This is a fern of comparatively the lower levels. . . . . The fronds are thick and coriaceous, and in dry weather roll up from the margins, and so remain for weeks and months, unrolling again, like

Niphobolus, on the return of wet weather." I confirm this. The fronds also sometimes coil up at the apex.

26. **P. simplex**, Sw., Syn. Fil. 27. *P. lineare*, Thb. β. *P. simplex*, Sw., Hk. and Bk. Syn. Fil. 354.

P. simplex, Sw., Clarke, Journ. Linn. Soc., XXV. 99. *Pleopeltis simplex*, Sw., Bedd. H. B. 347. *Polypodium* (*Phymatodes*) *simplex*, Sw., Blanford, in Journ. Asiatic Soc., Bengal, Vol. LVII., Pt. II., No. 4, 1888, Pl. xx.

PUNJAB : *Chamba*—McDonell, in List. Pangi—Satrundi, Harsukh (collr. from Sahar. Herb.) 1899 ; *Kangra Vy. Dist.*—Edgew. in Herb. Sahar. ; Dharmsála, Trotter ; Kullu 6-7000′, Trotter ; *Mandi State* 6500′, Trotter ; *Simla Region*—Simla 6-8000′, common.

N.-W. P. : *D. D. Dist.*—Jaunsar—Chakráta 7000′ ; in the Dún—Kalanga Hill 33000′, Gamble ; Mussooree and Landour, very common 6-7500′ ; *T. Garh.*—Jumna Vy. 10-11,000′, Ganges Vy. 10-12,000′ Duthie ; *B. Garh.* 8000′, Duthie, Mrs. Fisher ; *Kumaun* 6500′ to 9000′, S. & W., Hope, Duthie, Davidson, Trotter, MacLeod.

DISTRIB.—*Asia* : N. Ind. (Him.) Sikkim and Bhotán. China ?

This is a very common fern in the Himalaya, on trees, and it never ought to have been mixed up with *P. lineare*, for, besides other differences, and entire dissimilarity in appearance when growing, the fronds are herbaceous in texture, and wither and fall off directly the rains cease, or before that when a touch of cold, dry wind comes from the north. The fronds of *P. lineare* are persistent for another year at least. Blanford noted this, and said—"Their texture is thin, the venation distinct." The sori when young are completely covered and protected by peltate scales, up to 20 in number to a sorus, which fit together so closely that to the naked eye they sometimes look like one large involucre with a continuous margin outside the sorus. These scales disappear as the sporangia ripen and burst. The sori are occasionally oval or confluent.

This species is still mixed up with *P. lineare* in the Kew Herbarium. Specimens from the eastward of British India seem to vary a good deal, and there may be among them a new species.

27. **P. clathratum**, C. B. Clarke in Review 559, t. 72, fig. 1 ; Baker in Ann. Bot., Vol. V., No. XVIII. *Pleopeltis clathrata*, Clarke, Bedd. H. B. 348. *Polypodium* (*Phymatodes*) *clathratum*, C. B. Clarke, Blanford, in Journ. Asiatic Soc., Bengal, Vol. LVII., Pt. II., No. 4, 1888, Pl. xxi.

AFGHAN. : Kurram Vy.—10-11,000′ Aitch. 1879-80 ; Peiwar Kotal 7000. Collett 1879.

KASHMIR : *Pir Punjál* 11-12,000′, C. B. Clarke ; *Gilgit Dist.*—Nittar Vy. 10-11,000′, Duthie. Kajnag Range and Kamri Vy. 9-13,000′ Duthie 1892 ; Ridge between Kishenganga Vys., 9-12,000′, MacLeod 1891 ; Sind Vy.—Sonamarg 8000′, Gammie 1891.

PUNJAB : Hazára Dist.—Kagán Valley, Inayat (collr. Herb. Sahar.) 1897 ; *Chamba*—Ravi Vy. 7000′, MacDonell, Pángi 12,500′, J. Marten ; Mandi State 7-9000′

Trotter; *Kullu* 8-9000′, Trotter; *Simla Reg.*—Simla 7000′, Hope 1871; Simla—"abundant on trees on north side of Jako Mt. 7000′ and a little above that level, and ranges (eastward) up to at least 10,000′ on Kamalhori and Hattu," Blanford (in List); Hope, Trotter, Bliss.

N.-W. P.: *D. D. Dist.*—Jaunsar, Mrs. Stansfield; *T. Garhwal* 8-12,000′, Duthie; *B. Garh.* 12-13,000′ Duthie, Mrs. Fisher; *Kumaun* 9-14,000′ Duthie; Leesar Pass 14,000′, MacLeod 1893.

NEPAL W.: Kali Vy., near Kangua 11,000′, Nampa Gádh 12-13,000′, Duthie.

DISTRIB.—*Asia*: N. Ind. (Him.), N. China, *Hancock*.

Mr. Clarke's description seems to have been written from material gathered in a limited tract, and his drawing is by no means an adequate representation of the plant, which seems to have various forms. The figure shows fronds not more than 6 in. l., including the stipes; and Mr. Clarke says the fronds are small. Blanford's figure is better, as it is of a larger plant, and shows the venation more correctly; but it does not give the "sessile irregularly peltate and lacerate clathrate scales" which are mixed with the sporangia and are the characteristic feature of the plant. He gives a drawing of a scale from the rhizome, and says the fern is readily distinguished from *P. simplex* by its narrow linear fronds, the character of the venation, and the clathrate scales of the rhizome and sori, as if these were identical. Clarke's enlargement of a scale from the sorus is quite different from Blanford's from the rhizome, and is correct: both are clathrate, though their shapes differ. But, as Blanford says, the scales of the sori are not persistent, and it is not easy in dried specimens to find a specimen of them. On some fronds I find similar scales on the under surface quite unconnected with sori.

P. clathratum, if all the specimens so named be that species, varies very much in dimensions and shape of frond. Duthie's high-level examples, from Garhwal, Kumaun, and West Nepal, are generally smaller than even Clarke's figure shows, and are rather coriaceous with venation obscure, but they have the characteristic scales in the sori. Duthie's No. 5178 from the Kuari Pass, British Garhwál, 13,000′, has a comparatively broad frond and short stipes, like that of *P. simplex*: stipes 1¼—1½ in., frond 4½—8½ in. l., narrowed gradually to both ends, but it has the characteristic sorus scales in abundance. Some of my specimens from the Simla Region, gathered late in the season when withering, and with no scales in the sori, have stipes 2 in. l., and fronds 10—12 in. l. by ⅜—⅝ in. br. Some of the sori in these are linear—⅜ in. l. A frond from the Mandi State, collected by Trotter, has stipes under 2 in. l., with frond 12 in. by ⅝ in. A plant of Blanford's, from Kamalhori Mt., 9500′, is only 4 in. high, rather coriaceous, with venation obscure, scales wanting, sori oval or oblong. I collected plants of this form at Simla in 1871, and was then certain they were not *P. linearе*. Fronds from Chamba are 13 in. l. by ⅜ to barely ⅝ in. broad, very

membranous, stipes very short. I have never seen stipes as long as the fronds such as Clarke speaks of; but some of Duthie's from Kashmir are ⅔ths of the total length, and some of these have fronds ¾ in. br., and look like narrow *P. simplex*. If the nature of the scales is the main specific character, all these various forms are one species.

Blanford made a particular study of this fern at Simla, where it is very abundant on Jako mountain, and he was at first inclined to make two varieties besides the type; but in his finally printed list he gave that up. He says *P. clathratum* is quite distinct from both *P. lineare* and *P. simplex*, though it often grows with the last-mentioned, which it much resembles in texture and mode of growth. "The sori," he says, "are small, frequently oblong, of a bright orange colour, and sometimes confluent. . . . . The stipes are generally shorter, and the fronds longer and more linear than in the specimen figured by Clarke." The sori are sometimes very large, *e.g.*, in a specimen of MacLeod's from Kashmir they are one-eighth of an inch in the largest diameter, and more than one-quarter the width of the frond: these are full of scales. This species is not got in Mussooree, where both *P. lineare* and *P. simplex* are very common.

P. alberti, Regel—Descr. Pl. nov., No. XVIII, 122, from Turkestan, is exactly the same as a small form, called *P. clathratum*, from the Himalaya at high altitudes, which might perhaps be separated and put under *P. alberti*.

28. **P. membranaceum**, Don, β., *P. grandifolium*, Wall.; Syn. Fil. 360; *P. membranaceum*, Don, C. R. 560. *Pleopeltis membranaceum*, Don, Bedd. H. B. 355.

KASHMIR: Tawi Vy. 4-5000', Trotter.

PUNJAB: *Chamba State*—Chenab Vy. 5000', McDonell: "not common"; Kangra Vy. Dist.—*fide* Trotter; *Simla Reg.*—Simla, common.

N.-W. P.: *D. D. Dist.*—in the Dún: Nalota Khála and elsewhere at the foot of the Himálaya, 2500' and upwards; Mussooree 5-7000', on moist rocks, and trunks of trees, common; *T. Garh.* Aglár Vy. 4-5000', Duthie; *B. Garh.*—Mrs. Fisher; *Kumaun*—Mohargiri 6500', S. & W.; Naini Tál 6500', on rocks by the Lake, Hope 1861: not seen there in 1890 and 1894; elsewhere 25-5000', widely distributed.

DISTRIB.—*Asia*: N. Ind. (Him.) Sikkim and Bhotán; Assam—Khasia Dist. 2-5000': very common; Bengal—Parasnáth Mt. 3000', *Clarke*. S. Ind.—E. & W. Mts., 2-5000'. Ceylon. Tonkin. W. China—Yunnan, *Henry*. Philippines.

Usually large; but I have a fertile frond gathered in Kumaun, only 5 inches high, including the short stipes. All the specimens I possess seem to belong to Wallich's *F. grandifolium*, which is said to have sori smaller, and irregularly scattered.

29. **P. heterocarpum**, Bl. (non Mett.); β., *P. Zippelii*, Bl., Syn. Fil. 360; *P. Zipelii*, C. R. 561. *Pleopeltis Zippelii*, Bl., Bedd. H. B. 357.

PUNJAB: *Chamba*—Dalhousie, Col. Dyas, *fide* Bedd. in H. B.

DISTRIB.—*Asia*: N. Ind. (Him.) Sikkim and Bhotán, 2-6000′, common ; Assam—Khasia, 2-4000′, frequent, W. Manipur 1000′, *Clarke*. Ceylon. Malay Penins. Perak. Sumatra. Java. Borneo. Philippines. China—Yunnan, *Henry*.

I give this as a North-West Indian species solely on the authority of Colonel Beddome. Mr. McDonell, who lived for years in Chamba, close to Dalhousie in charge of the forests, never found it there. I do not think the habitat, " N. India," in the '*Synopsis*,' means including N.-W. India any more than it does when given for *P. iridiodes*, Lamk., the next N.-E. Indian species, or for *P. hemionitideum*, Wall.

30. **P. oxylobum**, Wall. Cat. 294. *P. trifidum*, Don, Syn. Fil. 363 ; *P. hastatum*, Thunb. var. 2 *oxyloba* (sp.) Wall., C. R. 563. *Pleopeltis hastata*, Th., Bedd. H. B. 362 ; *Pleopeltis trifida*, Don, Bedd. Suppt. H. B. 96 ; *Pleopeltis laciniata*, Bl., Bedd. in Journ. Bot., Aug. 1892.

PUNJAB : *Chamba*—Dalhousie, McDonell : "abundant" ; *Kangra Vy. Dist.*—Dharmsála 5000′, Trotter ; *Simla Reg.*—Simla 6200′, Blanf. : "very rare. In fact I know of only one locality for it, near Simla" ; Simla—3 stations, Bliss ; *Bisahir*—Taklech 5000′, Lace.

N.-W. P. : *D. D. Dist.*—Sowarna Nála 4500′ ? ; Badráj Mt. and 'The Park', on the Mussooree Ridge, Mackinnons 1878-79 ; 'The Park' 6300′, on trees, Hope 1887 and 1895 ; The Castle Hill 6100′, A. Hope 1885 ; C. W. Hope 1894 and 1895, in quantity, on a rock ; *T. Garh.*, Ganges Vy. 7-8000′, Duthie 1881 ; Dura 5000′, Gamble 1893 ; *B. Garh.*, Mrs. Fisher ; *Kumaun*—R. Blink 1827 ; Binsar 7000′, S. & W. ; near Naini Tál, Hope 1861, Nalena Vy. 4700′, Hope 1890 ; above Loharkhet 75-8000′, Trotter 1891 ; Kála Moni Ridge 8500′, MacLeod 1893.

DISTRIB.—*Asia* : N. Ind. (Him.) Nepal *Wallich* ; Sikkim and Bhotán : not common ; Assam—Khásia Dist. 2-6000′ : common, Kohima 6000′, *Clarke*. S. India—5000′-8600′. Ceylon, *Mrs. Walker*. China—Yunnan, *Henry*. Japan.

A thoroughly good species, in my opinion.

31. **P. malacodon**, Hook. ; Syn. Fil. 363 ; C. R. 564. *Pleopeltis malacodon*, *Hook.*, Bedd. H. B. 363.

PUNJAB : *Kullu*—Jalori Pass 10000′, Rohtang Pass 10-13,000′, Trotter 1887 ; *Simla Reg.*, Bates ; Kamalhori and Hattu Mts. 9-10,500′, on rocks, Gamble, Collett, Hope, Trotter, Bliss.

N.-W. P. : *T. Garh.*—not infrequent at 9-13,000′ alt., Mackinnons, Duthie, Herschel, Gamble ; *B. Garh.*—near Ramri 9-10,000′, and above it 12,000′, Duthie ; *Kumaun* Sarju R. 4500′, and Kala Mundi Pass 8000′, S. & W. ; Kali Vy. 12-13,000′, Duthie ; Pindar Gorge 10,000′, Trotter.

DISTRIB.—*Asia* : N. Ind. (Him.) 9-13,000′, Nepál to Bhotán.

Mr. Clarke says :—" A very common fern, known at once by its strongly serrate margin. It is remarkable that I find no example in the Kew Herbarium (other than my own) except some pieces mixed on a sheet of T. Thomson's, said to have been collected top of Hattu, alt. 10500′, in the North-West Himalaya." But Mr. Clarke restricted the range of habitat to 'Nepal to Bhotan'. Hattu Mt. is now a well-known habitat for *P. malacodon* : it was got there in 1876 by

Gamble, and in 1878 by Collett ; and, as will be seen above, the fern grows in many other places west of Nepál.

The scales of the rhizome have not been correctly described by Baker or Clarke : they are not " brown or nearly black," or " brown black." They are bicoloured, *i.e.*, pale-brown with a broad dark-brown streak down the centre. Clarke says—" Frond often sub-cordate at base." Among the numerous specimens in Gamble's and my collections I cannot find a frond that is not cordate or sub-cordate below. Many examples have sori oval or oblong, the major axis directed towards the margin. Some of Duthie's specimens from British Garhwal, 12,000', have sori biserial between the veins, often confluent. These grew on trees ; but elsewhere, so far as I know, the fern is always on rocks. I can see no resemblance to, or affinity with, *P. oxylobum*.

32. **P. cyrtolobum**, J. Sm., C. R. 563. *Pleopeltis Stewartii*, Bedd., Syn. Fil, 2d. ed. 573. *Pleopeltis malacodon*, Hook., var. *β. majus*, Bedd. H. B. 363, and Suppt. 96.

PUNJAB : *Chamba*—MacDonell ; *fide* Beddome in Suppt. H. B.

N.-W. P. : *D. D. Dist.*—Mussooree, " The Park " 63-6500', Mackinnons 1880, Hope 1887 and 1895 ; *Kumaun*—Binsar 7500', S. & W. ; Gori Vy., 7-8000', Trotter 1891 ; Mangalia Gor 10,000', MacLeod 1893.

DISTRIB.—*Asia* : N. Ind. (Him.) Nepál to Bhotán 9-12,000' : very common, *Clarke* ; Assam—Jakpho Mt. 8500' *Clarke* ; Khasia Dist. 5000', *Clarke*.

This species is not in McDonell's List of Chamba Ferns, and I have seen no specimen from the westward of Mussooree. Trotter in his printed list said he had a Chamba specimen from McDonell ; but the species does not appear in his later MS. list given to me ; and I have four fronds of *P. oxylobum* marked by him *P. cyrtolobum*.

I am not much surprised that writers with a tendency to unite species, and who have not seen this growing in its natural habitats, thinking it a form of *P. malacodon*, at least if they can get over the marked differences of cutting and scales of rhizome. But, having seen *P. malacodon* growing only on rocks in the Simla Region, at high elevations, and *P. cyrtolobum* growing only on trees in Mussooree, at a much lower elevation, and having observed their very different habit and appearance, I cannot hesitate to agree with Clarke in separating them. The scales of the rhizome are bicoloured like those of *P. malacodon*, but they are much narrower and darker coloured, and they end in long thick hairs. The frond is less cordate at the base, and sometimes quite decurrent on the stipes ; and the texture is much thinner than that of *P. malacodon*. The fronds vary from occasionally simple to three-lobed, and to three pairs of lobes, besides the long terminal lobe. Major MacLeod's two fronds in my possession, from Kumaun, are—one, trilobate, and the other, with stipes over 4 in., has a frond 10 in. l. with 4 pairs of lobes—the longest nearly 6 in. l. A frond from Mussooree is nearly 12 in. l., with terminal lobe all but 8 inches.

33. **P. Stewartii**, C. B. Clarke, in Trans. Linn. Soc., 2d. Ser., Bot., Vol. I., 563—the 'Review.' *Pleopeltis malacodon*, Hook., *P. Stewartii*, Clarke : a variety less serrated, Bedd. H. B. 363.

PUNJAB : *Chamba*—Ravi Vy., below Sach Pass, 9500', McDonell 1882 ; 9900', J. Marten 1898 ; *Simla Reg.*—Simla, near the Tunnel 7400', Bliss 1886-90-92.

N.-W. P. : *D. D. Dist.*—Seals' Hill, E. of Landour, 7000', Miss Parrott (by whom indicated to Hope) 1887 ; Hope 1895 : *Kumaun*—Binsar 7000', S. & W. ; top of Liria Kánta Mt. about 8000', Hope 1861 ; Summit of Dhankuri Pass 10,500' and Phurki, Trotter 1891.

DISTRIB.—*Asia* : N. Ind. (Him.) Sikkim 12-13,000', Lachen, *Sir L. D. Hooker*. China—*Henry*.

Beddome meant, I think, *P. cyrtolobum* as having been collected in Garhwál by (Dr.) Stewart, as this statement is made with reference to the fern depicted in his Plate 204 in F.B.I., which seems to be *P. cyrtolobum*. Clarke wrongly referred to that Plate under his *P. Stewartii*. This species hardly grows so large as its congeners do, and it is a stiffer plant—subcoriaceous in texture : the fronds do not hang down, but stand up, or spread out, if growing on the face of a rock. The paler scales on the rhizome distinguish it. It seems a rare plant. As to the Simla Region, Blanford says :—"Very rare, and has found atbeen only one place near Simla, on rocks at an elevation of about 7400 feet."

34. **P. ebenipes**, Hook.; Syn. Fil. 365 ; C. R. 564 ; *Pleopeltis ebenipes*, Hook., Bedd. H. B. 363.

PUNJAB : *Chamba*—McDonell, *fide* Trotter ; J. Marten 1898 ; Kullu 9-10,000', Trotter ; *Simla Reg.*, on ridge east of Simla 8-10,000'. T. T., Edgew., Bates, Blanford, Hope, Trotter, Bliss.

N.-W. P. : *D. D. Dist.*—Jaunsar—Harianta 8500', Gamble 1895 ; *T. Garh.* Nag Tiba Mt. 9000', Mackinnons ; under Bandarpunch 10-11,000', and Bok Mt. 9-10,000', Duthie ; *B. Garh.* 6-7000', on trees, Duthie, Mrs. Fisher ; *Kumaun*—Kalamundi 8700', S. & W., Dhankuri Pass 8-8500', Trotter, Kala Muni and Mangalia Gor Ridges 8-10,000', MacLeod.

DISTRIB.—*Asia* : Tibet—Yatung, *Hobson* ; N. Ind. (Him.), Sikkim and Bhotán.

Besides the broad, black, opaque, polished scales on the rhizome a marked distinction between *P. ebenipes* and its congeners is the much greater number of lobes, and consequently the longer frond ; the number of lobes seems to be 7-13 pairs. There are no fronds of *ebenipes* decurrent at base in Gamble's and my collections. Otherwise, Beddome's remarks as to the distinctions between members of this group seem good.

Subgenus PLEOPELTIS, *H. & B.*

35. **P. juglandifolium**, Don ; Syn. Fil. 368 ; C. R. 566. PLEOPELTIS, Bedd. H. B. 308. *Polypodium capitellatum*, Wall. Cat. 306.

PUNJAB : *Simla Reg.*—Simla, Lady Dalhousie 1881 ; Bisáhir, Taklech 5000', Lace.

N.-W. P.: *D. D. Dist.*—Landour 7000′, Colonel Wilmer (comm. to Mackinnons 1878); Seal's Hill, E. of Landour, Hope 1887 and 1895; *T. Garh.*—between Ora and Ramsarai, Duthie's collr. 1879; between Betwari and Dangulla 5-6000′; 7-8000′, Duthie 1881; Kidarkanta; Jodargádh Waterfaff and rocks near Suránu-ka-Ser 6000′, Gamble 1898; *B. Garh.* 7-8000′, Duthie 1885, and Mrs. Fisher; *Kumaun*—Sarjn R. and Pass to Mohargiri, S. & W. 1848; Naini Tál 7000′, on trees, Hope 1861; Goriganga Vy. 6-8000′, MacLeod 1893.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál, *Wallich*; Sikkim and Bhotán; Assam—Khasia 2000′-5000′, very common, *Clarke*; Kohima—Jakhpo Mt. 7500′, *Clarke*; Manipur 7500′. Burma—Moulmein, China—Yunnan, *Henry*, Yunnan—Mengtez, *Hancock*, "very rare."

Perhaps the omission of localities for the type, from Beddome's Handbook, is due to a misprint. None of the specimens I have from N. and W. India are petiolate, and otherwise they seem quite normal. At Naini Tál I used to see this fern growing on trees. At Mussooree (Landour) it grows in dense masses on a steep bank, under scrub forest, the fronds hanging down gracefully. In Kumaun MacLeod found it growing in large overhanging masses on precipitous rocks. I have a frond, Trotter's No. 959, 1891, from near Naini Tál, named by him *P. jimalayense*, Hk., which I now think is *P. juglandifolium* var. *biserialis* of Clarke, which was got in Kumaun long ago, *vide* a specimen in the Kew Herbarium. The form *B. P. tenuicauda*, Hk., does not appear to have been got in N.-W. India.

86. **P. Lehmanni**, Mett.; Syn. Fil. 369; C. R. 566. *Pleopeltis*, Bedd. H. B., 370.

N.-W. P.: *B. Garhwál*—near Ramri 12,000′, on rocks in forest, Duthie No. 5177, 1885; loc.? P. W. Mackinnon; Mrs. Fisher.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál, *Wallich*; Sikkim 4-8000′, common, *Clarke*. Burma. China—Yunnan, *Delavay*, *Henry*.

Duthie's plant from British Garhwal is a remarkable sport. The specimen he gave me is one frond, with three inches of rhizome sending out side-shoots. The scales are typical. The stipes is 5½ in. l.—the frond 10 in. l., 8½ in. br.: pinnæ 5 pairs, sessile, lowest 4½ in. l., and next 3 pairs not much shorter: all, and the terminal pinna, have the veins irregularly prolonged, so that the lowest pair of pinnæ are in places 3 in. br.: the pinnæ are very opposite and very acuminate. There is a similar specimen in Kew, also from Duthie. No fertile fronds of this were found by Mr. Duthie. I have lately received from Mr. Gamble two fronds, quite typical, collected in British Garhwal by Mrs. Fisher, with pinnæ very opposite and very acuminate. Mr. Mackinnon's specimens want rhizomes; but I have other grounds for believing this species grows in Garhwal, for fronds of what I could only so name grew up from among a mass of rhizomes of—I forget what other species—which the Mackinnons brought from an inner range of the Himalaya, and had in cultivation at Mussooree, about 1881.

Genus 28. NOTHOCHLAENA, *R. Br.*

1. **N. vellea**, R. Br., Prod. 146; *N. lanuginosa*, Desv., Syn. Fil. 370. *N. vellea*, R. Br., Bedd. H. B. 375.

AFGHAN.: Griffith, in Herb. Hort. Kew; see also Baker in Ann. Bot. V., No. XVIII.

KASHMIR: *fide* Beddome in Handbook.

PUNJAB: *Chamba*—Ravi Vy., below Pokri, 3500' and under: "also found in other places at 3500' or so," McDonell 1882; "Chamba", 3000'. J. Marten 1897; Kangra Vy. Dist.—Lahaul, *fide* Bedd. H. B., Pángi and Lahaul, 9-12,000', Dr. Watt, in Herb. Hort. Kew.

DISTRIB.—*Eur.*: Spain, Sardinia, Italy, Sicily, Greece, Crete. *Asia*: Syria; S. Persia, *Dr. Stapf*; E. Persia, *Bornmüller*. *Australia*: temperate and tropical. *Afr.*: Macaronesian Isles, S. Morocco, *J. D. Hooker*, Algeria, Nubia.

I think this fern was found in Chamba (or Kashmir) by Mr. Ellis before Mr. McDonell found it. Mr. McDonell did not know it, and sent it to Mr. Levinge, and to me—or Levinge sent it to me. Levinge marked it "Woodsia sp."? I recognised it as *N. lanuginosa* from a coloured drawing in 'Britten's European Ferns.'

Mr. Marten has quite lately found it in the Chamba State.

2. **N. Marantae**, R. Br.; Syn. Fil. 371; C. R. 567; Bedd. H. B. 373.

KASHMIR: *fide* Clarke in 'Review.'

PUNJAB: *Chamba*—Ravi Vy., Thála 11,000', McDonell 1885; *Kullu*, summit of Jalori Pass 10,500', Trotter; *Simla Reg.*—ridge E. of Simla 8000' to 10,200', Bates, Blanf., Hope, Trotter, Lace, Bliss.

N.-W. P.: *D. D. Dist.*—Jaunsar 9000', Rogers; *T. Garh.*—Nag Tiba Mt. 9-10,000', Mackinnons; Deota 8000', Gamble 1893; Balcha, Rogers; Jamnotri 10-11,000', Duthie 1884; *B. Garh.*—above Ramri 8-9000', Dombitia Gádh 9000', Kuari Pass 11-12,000', Duthie; *Kumaun*—S. & W., Kali Vy. 9-10,000', Duthie and J. R. Reid, Pindar Gorge 8000', Trotter.

DISTRIB.—*Eur.*: The Continent throughout the Mediterranean Region, extending to the Tyrol and Hungary, and to Ardêche and Portugal: in Spain upon the mountains up to 3000'. *Asia*: Syria and Tauria; Tibet—Yatung *Hobson*; N. Ind. (Him.) Sikkim—Lachen Vy. 9-15,000', *Hook. Fil.*; *Dr. King's collr.* 14,000'. *Afr.*: Macaronesia, Barbary States and Abyssinia.

Genus 29. GYMNOGRAMME, *Desv.*

Subgenus LEPTOGRAMME, *J. Sm.*

1. **G. Totta**, Schlecht; Syn. Fil. 376; C. R. 567. *Leptogramme Totta*, Schlecht., Bedd. H. B. 377.

KASHMIR: *fide* Clarke in 'Review.'

PUNJAB: *Chamba*—Ravi Vy. 6000', McDonell; *Kullu*—Outer Scoráj 7000', Trotter, 6-8000', Coventry; *Simla Reg.*—The Chúr (or Chor) Mt. Herschel; Simla—Bliss 1886-90-92.

N.-W. P.: *D. D. Dist.*—Jaunsar, Harianta 7000', Kathián 7500', Gamble; *T. Garh.*—Cháchpur Vy. 6000', Duthie; P. W. Mackinnon, very long; *Kumaun*—T. T.; Jagesar 6000', S. & W.; Edgew., Hawalbágh, in Herb. Sahar.; Davidson; near Devidhura 6000', Trotter.

J.N.Fitch del. Chitre Silpi Co Lith.

GYMNOGRAMME LEVINGEI Baker.

1. Rhizome; natural size.
2. Lower portion of frond; natural size.
3. Portion of a pinna, enlarged 8 diam.

DISTRIB.—*Asia* : N. Ind., Assam *Griffith*; Khasia 3-5000′, common, *Clarke*. S. Ind.—very common on west side, at highest elevations, *Beddome*. Ceylon. Sumatra and Java. Japan. China. Korea. *Afr.* : Macaronesia; Guinea Coast; Fernando Po, and Kamerun Mts., G. Mann. Abyssinia. Cape Colony. Comoro Islands.

2. **G. Levingii**, Baker, in Annal. Bot., Vol. V., No. XVIII., 216. *G. aurita, var. Levingii*, C. R. 568. *Leptogramme aurita, var. Levingii*, Clarke, Bedd. H. B. 379; *Leptogramme Levingii*, Bedd. Suppt. H. B. 99.—Plate *XXXV.*

The following is Mr. Baker's description of the Plant :—

" Rhizome slender, wide-creeping; paleæ lanceolate, membranaceous. Stipe slender, naked 6—8 in. long, stramineous, with a brown base. *Frond* lanceolate, or oblong-lanceolate, bipinnate, membranous, pubescent, 1—1½ ft. long, 3—4 in. br. at the middle, narrowed to the base. *Pinnæ* lanceolate, sessile, ½—¾ in. broad, cut down to the rhachis into continuous erecto-patent, linear-oblong *pinnules*. Veinlets erecto-patent : upper simple, lower forked. *Sori* oblong or globose, placed nearer the margin than the midrib. West Himalayas; Jhelum Valley, alt. 4000′; Levinge. I follow Mr. C. W. Hope in treating this as a species."

Mr. Clarke, in giving this fern as a variety of *G. aurita*, Hook., said—" It has the texture and hairiness of *G. Totta*, but the rhizome and venation of *G. aurita*; while the cutting is deeper than that of *G. Totta*, less auriculate than that of *G. aurita*."

I will not attempt to check the various descriptions of the plant, for it might end in writing another, and there are already enough; but I figure it, as that has not yet been done.

KASHMIR : Palgam 8000′, C. B. Clarke. *Gilgit Dist.*—Dashkin 7500′, Dr. Giles; Jhelum and Chitapáni Vys. 4-7000′, Levinge 1875, Gulmarg 75-8000′, Sind Vy. 7000′, Trotter; Pir Punjal—Hirpur 7000′, Sind Vy., Gund, 6000′, Gammie; Farikand Nála 6-7000′, MacLeod—" on the edge of the stream, not under shade. Does not grow away from water."

PUNJAB : *Hazára Dist.*—Kagán Vy., Inayat (Sahar. Herb. collr.) 1899; *Chamba*—above Alwás, and Sach Vy. 8000′, McDonell; " Chamba," J. Marten 1898, Pángi 8500′, Harsukh (Sarhar. Herb. collr.) 1899; Kullu, Trotter in List; *Simla Dist.*—eastward from Simla a ridge, near Theog 8000′, Kamalhori and Hattu Mts. 85-9400′, Hope, Blanford, Bliss, Dr. Watt. Kunáwar, T. T. 1847.

N.-W. P. : *D. D. Dist.*—Jaunsar (or *T. Garh.*) : Collected on march from Mussooree to Chakrata, Mrs. J. Sladen, 1880; *T. Garh.*—Nag Tiba Mt., Mackinnons 1879; Ganges Vy., below Harsil and Derali 8-9000′, Duthie 1881; Mandraoli 10—11000′, Duthie 1883; *Kumaun*—between Gini and Munshiari 7-8000′, Dhauli Vy. 9-10000′, Duthie " *Kumaun*," J. R. Reid 1886.

This fern varies a good deal in shape and cutting of frond. I had a frond 10 in. l., but only 2½ in. br., and another (Hattu Mt., Bliss) which is 18½ in. l. by 7¾ in. br. The greatest width Baker gives is 4 inches, and Beddome—

5½. The rhizome is very slender, and in general not thicker than the stipes. My observation bears out Blanford's and MacLeod's statements as to its love for water or wet ground. Blanford considered this a good species.

Subgenus EUGYMNOGRAMME.

3. **G. vestita**, Hook. ; Syn. Fil. 379. Subgenus SYNGRAMME, *G. vestita*, Hook. C. R. 568. *Syngramme vestita*, Wall. Cat. 12 (under *Grammitis*), Bedd. H. B. 386.

PUNJAB : *Hazára Dist.*—Black Mt. 6900′, Trotter ; *Chamba*—McDonell, 1885 or previously ; *Mandi State*—near Badwáni 7000′, Trotter 1887 ; *Simla Reg.*—Simla 55-7000′, frequent ; eastward along ridge, to Kamalhori Mt. 8-9000′, Bates, Gamble, Blanford, Hope, Bliss.

N.-W. P. : *D. D. Dist.*—Jaunsar, Lokandi 7000′, Konain 7000′, Gamble ; Lakhwá, Gammie, " Jaunsar " Mrs. Stansfield 1883 ; Mussooree 6500′, Mackinnons 1878-79 ; *T. Garh.* Kidar Kánta Mt. Dr. Royle, and eastward from Landour, 7-7500′, Levinge 1872 ; Deota 6000′, Gamble ; Ganges and Jumna Vys. 7-9000 Duthie ; *B. Garh.* 6-7000′, Duthie ; near Joshi Matt, Mackinnons ; Mrs. Fisher ; *Kumaun*, Wallich 1829 (R. Blink.) in many places—55-8000′, S. & W. ; Edgew., Hope, Davidson, Duthie, Trotter, MacLeod, 1861 to 1893.

DISTRIB.—*Asia* : N. India (Him.) Bhotán. China, North and South.

The rhizome is procumbent, slow growing.

The pinnæ in large specimens become bluntly auricled at base on the upper side, or on both sides—sub-sagittate.

4. **G. Andersoni**, Bedd., Ferns of British India, p. , t. 190 ; Syn. Fil. 380 ; C. R. 568 ; *G. Andersoni*, Bedd. H. B. 382.

N.-W. P. : *T. Garh* —Gumbar Pass 12-13,000′, Duthie ; *B. Garh.*—near Kuari Pass 11-12,000′, Duthie ; *Kumaun*—Pindari 12,000′, S. & W. (*Woodsia mollis* on ticket) ; above Namik 11,000′, No. S, 695, F. ; Sundadunga Vy. 13,000′, Dr. Anderson ; Káli Vy , above Garbyáng 11-12,000′, Duthie, Byáns—above Chalek 11-13,000′, and Palang Gádh 11,000′, Duthie.

NEPAL W. : Nampa Gádh 11-12,000′, Duthie.

DISTRIB.—*Asia* : N. Ind. (Him.) Sikkim 14-16,000′, *Hook. Fil.*

" *Woodsia lanosa*, Hook., must be placed here as a synonym " : Baker in Ann. Bot., Vol. V., No. XVIII.

5. **G. javanica**, Bl. ; Syn. Fil. 381 ; C. R. 569. (Subgenus *Syngramme.*) *Syngramme fraxinea*, Don (under *Diplazium*), Bedd. H. B. 386.

KASHMIR : Rattan Pir 75-8000′, Trotter ; Dardpura and Audr'bug 6000′, common, MacLeod.

PUNJAB : *Hazára Dist.*—Murree, Hope 1882, Trotter 1886 ; *Chamba State*—Kalatop Forest, 6-7000′ and upwards, MacDonell ; 5-7000′, J. Marten 1897 ; Kangra. Vy. Dist.—Dalhousie, C. B. Clarke ; *Simla Reg.*—Simla and eastward along Thibet Road, 5-10,000′, common in forest, Edgew, Madden, Hope, Gamble, Blanford, Trotter, Bliss. Giri Vy.—Raiengarh Forest 7000′, Gamble.

N.-W. P. : *D.D. Dist.*—Jaunsar, Mandáli 8000′, Gamble ; Mussooree 4-5000′, several stations, Duthie, Mackinnons, Hope ; *T. Garh.* Srinagar, R. Bl., Bok and Nag Tiba Mts.

9-10,000′, Mackinnons, Duthie; Bambu Vy. 6000′, Gamble; *B. Garh.* Mrs. Fisher; *Kumaun*—near Khâti 7200′—7800′ (both forms) S. & W.; near Naini Tâl 45-6000′, Hope, Konoor 7000′, Davidson; near Bugeswar 3500′; Dhankuri 9000′, Trotter; Sarjuganga Vy. and elsewhere, 2-6000′, MacLeod.

NEPAL, *Wallich*, Centr. Nepàl, *Scully*.

DISTRIB.—*Asia*: N. Ind. (Him.) E. Nepâl *J. D. Hooker*; Sikkim and Bhotân; Assam—Khasia Dist. 1-5000′, common. Burma—Tenasserim. Ceylon—5-6000′. Malay Penins. and Isles. Tonkin. Phillipines. China—Shensi, Giraldi, Nau-T. *Henry*; Yunnan, *Delavay*, *Hancock*; Shing-King Prov., between Mukden and Kirin, *James*. Japan. Polynesia. *Afr.*: E. & W. Tropical; Kamerun Mts., Fernando Po, St. Thomas. Madagascar.

Beddome describes two forms—pinnate and bipinnate; but plants of a form between these two are frequent, *i.e.*, with perhaps only one pair of pinnæ pinnate, and that irregularly so; and there is also a tripinnate fern, as Blanford pointed out. The simpler forms generally grow at low levels, and have large, broad, pinnæ and the compound forms always at high altitudes, with small narrow pinnules. The number of pinnæ varies greatly.

Looking to the contrast which the low-level form—with stout stipes and rhachis, and large, simple pinnæ, or with only the lowest pair pinnate or partly so—presents with the high level form, bi- or tri-pinnate, with slender stipes and rhachis, and with small, narrow pinnules, and also to the differences of margin, I am not surprised that several species have been made out of this plant; but I do not think this is necessary. Blanford says:—"Below 6000′ it is bipinnate only as regards the lowest pair of pinnæ and the pinnules are broad and large. Specimens from higher elevations have several pairs of pinnæ again pinnate, and the pinnules are smaller and narrower. It is often 3-pinnate." This is well expressed; but the purely simply pinnate form is not mentioned. The venation varies: in some fronds the veinlets stop short of the margin, and are thickened (clubbed) at the ends, the marginal teeth in that case being quite disconnected from the veins: in most cases the veinlets run into the teeth, and quite to the margin. The anastomosis of veinlets of contiguous groups is, as Beddome says, rare, and I have detected it in only 3 out of 25 fronds. The re-uniting or looping of forked veinlets within the same group is commoner. The veinlets get so close towards the margin that I wonder how, in the simpler broad segment form, they keep separate.

6. **G. leptophylla**, Desv.; Syn. Fil. 383; Bedd. H. B. 382, and Suppt. 100.

N.-W. P.: *D. D. Dist.* Mussooree, Dr. Bacon: in Herb. Hort. Kew.; *Kumaun*—Colonel Davidson 1877, in Herb. Hort. Saharanpur: also in Herb. Hort. Kew.

DISTRIB.—*Amer.*: Andes of Mexico and Ecuador; Paraguay. *Eur.*: Jersey, France; Switzerland; Spain and Portugal, Italy and Sicily, Corsica and other Mediterranean Islands, Greece, Turkey. *Asia*: Persia. S. Ind.—W. Ghâts, Ootacamund,

Mahableshwar, Satára Fort walls. Ceylon—*Trimen*. Australasia—N. S. Wales, Tasmania and N. Zealand. *Afr.*: Macaronesia, Barbary States and Abyssinia; Cape Colony and Madagascar.

This species, and two others, are annual, and form the genus *Anogramma* of Link. (Syn. Fil.) Mr. Marquand, a well-known authority on *Algæ*, tells me that *G. leptophylla* is in some years plentiful in Jersey, and sometimes comparatively rare.

Subgenus SELLIGUEA, *Bory*.

7. **G. involuta**, Hook.; Syn. Fil. 387; C. R. 570. *Loxogramme involuta*, Don (under *Grammitis*), Bedd. H. B. 393.

PUNJAB: *Simla Reg.*—Simla 5-6000', Lady Dalhousie, Hope, Blanford, Trotter, Bliss.

N.-W.-P: *D. D. Dist.*—Mussooree and neighbourhood, in various places 47-6500', on trees, Edgew. Duthie, Mackinnons, Hope; *T. Garh.*—Phedi 4-5000', Duthie; *B. Garh.*—below Kinoli 5000', Duthie; Mrs. Fisher, *Kumaun* 4-8500', on trees and rocks: plentiful in some places, R. Blink., S. & W., Hope, Davidson, Duthie, MacLeod

DISTRIB.—*Asia*: N. Ind. (Him.) Nepál *Wallich*, Sikkim and Bhotán; Assam—Khasia Dist. 1-5000', very common, N. Manipur 5500', *Clarke*. S. India—5-8000', Ceylon 5-8000. Malay Penins.—Penang, *Wallich* 1822. China: Yunnan—Mengtsz, *Hancock*, *Henry*; Szechwan *Faber*. Philippines, Polynesia—Solomon Isles.

8. **G. elliptica**, Baker; Syn. Fil. 389; C. R. 570. *Selliguea elliptica*, Thunb., Bedd. H. B. 392.

N.-W. P.: *D. D. Dist.*—Sowarna Nadi, 4500', Mackinnons 1878-79, P. W. Mackinnon and Hope 1881; in the Dún—Nalota Khála 2500', Hope 1881, 1889, and 1891: station shown to A. Campbell, Trotter, and Gamble in 1891.

DISTRIB.—*Asia*: N. Ind. (Him.) Sikkim and Bhotán; Assam—Khasia Dist., 2500'-5000', very common, Kohima 45-6000', *Clarke*, N. Manipur 4500', *Clarke*. Burma—Tenasserim Prov. Malay Penins. Tonkin, Philippines, Japan, China. Formosa. Australia—Queensland.

I think it is a mistake to put this species, as Baker and Beddome do—* * Fronds compound;—there is always a wing, though sometimes nearly interrupted, to the main rhachis in even the longest and most developed fronds; and Thunberg's name, *elliptica*, and Presl's—*decurrens*, seem to imply this. The fronds are as much a-pinnate as are those of the series of *Polypodium* (Phym.) from *oxylobum* to *ebenipes*; but the main veins or secondary rhachises are stouter than those of the *Polypodiums*. Baker says—"Oldham gathered in Formosa a form with the fronds quite entire," and Clarke says he has an example, in full fruit, quite simple. I have some fronds, gathered in the Dehra Dún from young rhizomes, which are 2—3 in. l., quite simple, but sterile, and I think this simplicity goes to prove that the plant has not pinnate fronds.

A specimen of *G. elliptica* from the Dehra Dún has stipes 13½ in. l., and frond 16×11 in.: it has 7 pairs of lobes, and a terminal. This fern, when dried, tinges paper pink, as does also *Asplenium ensiforme*.

Genus 30. VITTARIA, *Sm.*

Sub-genus TÆNIOPSIS, *J. Sm.*

1. V. lineata, Sw.; Syn. Fil. 396. *V. flexuosa*, Fée, C. R. 574. *V. lineata*, Sw., Bedd. H. B. 407.

PUNJAB: *Kangra Vy. Dist.*, Mr. D. Macdougall, *fide* Trotter in printed List.

N.-W. P.: *D. D. Dist.*—Vicary, in Herb. Hort. Sahar.; *T. or B. Garhwal* 4-5000′, P. W. Mackinnon 1881; *B. Garh.* 7-8000′, Duthie 1885; *Kumaun*—Sarju Vy. 4800′, S. & W., above Gini 6-7000′, near Sosa 9-10,000′, in forest, on *Abies dumosa*, Duthie 1884; near Kháti 7500′, and above Loharkhet 8-8500′, Trotter 1891; above Girgaon 9500′, "common trees," MacLeod 1893.

DISTRIB.—*Amer.*: W. Indies and Florida to Peru and Brazil; Brit. Guiana—Roraima. *Asia*: N. Ind. (Him.), Sikkim and Bhotán: "2-12,000′, very common," *Clarke*; Assam—Khásia Dist. 1-6000′, very common; Kachar; Manipur, *Watt.* S. Ind.—on the Western Mts. 2-6000′. S. Andaman Island, *Kurz.* Ceylon, C. P., common. Malay Penins. and Islands. Tonkin—*Balansa.* China—Yunnan, *Henry, Hancock*; Fokien *Carter.* Japan, Philippines, Borneo. New Guinea. *Afr.*: Kameruns. Guinea Coast, Ashanti. *Centr. Afr.*—Ruenzori, Zambesi Land, Natal, Cape Colony. Mascaren Islands, Seychelles.

Tribe B. ACROSTICHEÆ.

Genus 60. ACROSTICHUM, *L.*

Sub-Genus GYMNOPTERIS, *Bernh.*

1. A. (Gym.) *virens*, Hook.; Syn. Fil. 420. *A. crispatulum*, Wall. Cat. 24, Clarke's Rev., p. 580, Pl. LXXXIV, fig. 2, b, d.—"Barren pinnæ numerous, often 20 or more, 4 by ½ in., slightly serrate, the midrib often reddish when dry, a series of costal arches, without included veins in any of the areolæ; fertile pinnæ 4 by ⅛ to ¼ in.

"Round Bengal from Kumaun to Bhotán and Chittagong in the lower hills, alt. 0-3000′, common.

"The only very common species of the group called *A. virens* by Mr. Baker. Very constant in character, and easily recognised by the absence of free veins."

N.-W. P.: *Brit. Garh.*, up to about 3000′; Bhainskil, near Parewa, Kotah Range, coll. Ináyat Khán (native collr. of Sahar. Herb.) 6-1902; *Kumaun*: R. Bl., 2 sheets in Herb. Hort. Kew.

This species is the only *Acrostichum* that has hitherto been found in N.-W. Ind.

Sub-Ord. III. OSMUNDACEÆ.

Genus 31. OSMUNDA, *L.*

1. O. Claytoniana, L.; Syn. Fil. 426; C. R. 582; Bedd. H. B. 449.

KASHMIR: Gulmarg 95—10,000′, *C. B. Clarke* 1875, Levinge 1875, Trotter; 8-9000 Duthie; Sarpat Peak over 10,000′: "grows in regular fields, coming up through the melting snow." MacLeod.

PUNJAB: *Chamba*, 8000′ McDonell; Kullu, 6-11,000′ Trotter; *Simla Reg.*—Bisahir, Chini, Vicary 1831, in Herb. Hort. Sahar.; Bári 8000′ Lace; Hattu Mt. 10,000′, Bates, Blanford, Hope, Bliss; Sirmur Territory 9-10,000′.

N. W. P. : *D. D. Dist.*—Jaunsar, Molta Forest, 4-5000′, Gamble ; *T. Garh.* Deota 8000′ and Bamsu 9000′ Gamble ; Kidár Kánta Mt. and near it 10-12,000′, Col. Bailey, R. E., and Duthie ; Nag Tiba Mt. 9000′, Mackinnon's ; Deráli : Damdar Vy. 9-11,000′, Duthie ; *Kumaun*, Wallich 1829, above Namik 8500′, Rálam 12,000′, S. & W. ; ascent from Ramganga R., 8500′, S. & W., Rálam Vy. 11-12,000′, Duthie ; Pindar Gorge 9-10,000′, Trotter ; Gori Ganga Vy. 10-11,000′, MacLeod.

DISTRIB.—*Amer.* : Canada, Newfoundland, and throughout the United States. *Asia* : (Him.) Sikkim : Lachen 9000′, *J. D. Hook.* ; Bhotán *Griffith*, 6000′, *C. B. Clarke* ; Assam—Khasi Hills, *Griffith* and *T. Thoms.*

This fern grows much larger than is stated in the '*Synopsis*,' namely, *st.* 1 ft., frond 1—2 ft. l. I have gathered it in the Simla Region with fronds 4½ ft. long, exclusive of stipes. It unrolls its fertile fronds in May or June, and withers early.

2. **O. regalis**, L. ; Syn. Fil. 427 ; C. R. 583 ; Bedd. H. B. 450.

PUNJAB : *Chamba State*—Ravi Vy. (Bhandál Vy.), 5000′ and over, and Langera 6000′, McDonell 1882, 7000′ ; J. Marten 1897 ; *Simla Reg.*—Simla, below 6000′, Blanford in List, 1888, "very rare, and now nearly extirpated by assiduous collectors."

N.-W. P. : *D. D. Dist.*—Jaunsar, Molta Forest 4500′, Duthie, and Gamble, 1895. *T. Garh.*—Kidarkanta Mt. 12,000′, Herschel 1879. *B. Garh*, 5-6000′, P. W. Mackinnon 1881 ; *Kumaun*, T. T., S. & W. ("L. speciosa, Wall.") ; Hawalbágh, in Herb. Hort. Sahar. "Asplenium 12 ; 25-6-49 " on ticket ; Gori Ganga Vy.—Ranti 8500′, MacLeod.

DISTRIB.—*Amer.* : Canada and the Saskatchewan to Brazil (Rio Janeiro) *Europe* : British Isles. Sweden and Russia to Spain, Italy and Turkey, Mingrelia, *Szovitz* ; *Asia* : Siberia ; N. Ind. (Him.) Sikkim and Bhotán ; Assam—Khasia Dist. 4-6000′, "common, or at least frequent", *Clarke* ; Kohima—Jakpho Mt. 7000′, *Clarke* ; Centr. Provs. : Pachmarhi, *Duthie* ; Bombay Presy.—Mts. of Malabaria (Clarke in 'Rev.'), S. Ind., common on the W. Mts. at the higher elevations. S. & W. China ; Hongkong. Japan. *Afr.* : Azores, Algeria, Tunis, Abyssinia, Angola ; Centr. Afr., Nyassa Land, Zambesi Land. Natal and Cape Colony. Mascaren Islands.

Indian plants of this fern all seem to be small,—well within the dimensions given in the '*Synopsis*,' and copied by Beddome, namely, *st.* tufted, 12—18 in. l., *fr.* 2—4 ft. l., 1 ft., or more, broad. It is well known that the European plant grows to much longer dimensions—up to 12 ft. in height.

Baker says—" *O. japonica*, Th. (*O. speciosa*, Wall.) is a curious variety from Japan and the Himalayas, with the fertile and barren fronds often quite distinct, the former being developed the earliest, and soon disappearing. . . . . Mr. McKen sends a similar form from Natal." And in the summary of New Ferns, 1891, Mr. Baker says—" *O. japonica* has been gathered in Angola by Mr. H. H. Johnston." Mr. Clarke says—" The common Khasi form is very small, 12—18 in. high ; the fertile and barren fronds quite separate : this is *O. japonica*, Thumb. ; *O. speciosa*, Wall. But I have collected fronds of this barren below, fertile above." This seems to be the normal, if not the only, form in Japan : I have not seen the rhizome of it.

In Chamba McDonell never got a fertile frond of *O. regalis*. In Jaunsar and British Garhwál specimens the fertile and sterile fronds are quite separate. *Duthie and Gamble* got both kinds of fronds on the same date, in May. Duthie's specimens from Pachmarhi, in the Central Provinces, India, and Gamble's from the Madras Presidency, are typical *O. regalis*, but small.

Sub-Ord. IV.—SCHIZÆACIÆ.

Genus 32. LYGODIUM, *Sw.*

Sub-genus EULYGODIUM, Veins free.

1. **L. microphyllum**, R. Br. ; *L. scandens*, Sw., Syn. Fil. 437 ; C. R. 583 ; Bedd. H. B. 455.

TRANS.-IND. STATES : *Baraul*—Ziárat Vy , 5000′, General (now Sir Wm.) Gatacre, 1895 : see "Ferns of the Chitral Relief Expedition," Journ. Bot., Vol. XXXIV., No. 379, March 1896.

DISTRIB.—*Asia* : N. E. Him., Bhotán, *Nuttall* ; Bengal Plain, rare—Cooch Behar, Sylhet, Chittagong, *Clarke*. S. Ind.—very common up to 3000′. Ceylon, abundant. Malay Penins. and Isles. S. China. Australia—Queensland. *Afr.* : Guinea Coast.

The only material from the Trans-Indus States consists of a part of a frond with only sterile pinnæ, the shape of which agrees with those of *L. microphyllum*, and they are unlike those of the other species of *Lygodium* which have been found in N.-W. India. Mr. Clarke considers *L. microphyllum* the best marked and least variable species of the genus. It has not before been found in N. India west of Bhotán, Assam, and the plain of N. Bengal. General Gatacre's plant was got in about N. Lat. 35°-25′, and E. Long. 71°-50′. Mr. Gamble agrees with me in the identification of this specimen, and says it is an interesting problem in geographical distribution—how this and *Pteris ludens* (see *supra* Vol. XIII, No. 3, p. 457), got into the Chitral Region.

2. **L. pinnatifidum**, Sw. ; Syn. Fil. 438. *L. flexuosum*, Sw., C. R. 584 ; Bedd. H. B. 457. *L. salicifolium* (Presl), Prantl, quoted by Baker in Ann. Bot., Vol. V., No. XVIII.

N.-W. P. : *D. D. Dist.*—Very common in scrub jungle and forest, 1-3000′, Mackinnons, Hope, Duthie, A. Campbell, and Gamble ; *Kumaun*—2-5000′, S. & W., Hope, Davidson, Duthie ; *Sajahanpur Dist.*, near Indalpur, Duthie 1885 ; *Gorakhpur Dist.*—Ramgarh Forest, 6 miles from Gorakhpur, A. Campbell 1887.

DISTRIB.—*Asia* : N. E. Ind. (Him.) up to 5000′ : Bengal—throughout the Plain, abundant, *Clarke* ; S. Ind., on both sides of the Madras Presy., common up to about 4000′, *Beddome*. Ceylon. Malaya. Philippines. N. Australia. *Afr.* : Angola, Guinea Coast.

This fern is common in the Dehra Dún. The fronds from the same root twine together, and if there is a small tree within reach together twine round its trunk to a considerable height. I have measured a plant trailing on the ground, which was 12 ft. in length. The rhizome is small, erect or suberect : stipes approximate, wiry, covered at base with minute black-brown scales : naked above.

3. **L. japonicum**, Sw.; Syn. Fil. 439; C. R. 584; Bedd. H. B. 457.

KASHMIR: *fide* Clarke in 'Review'; Poonch Vy. 3000', Winterbottom; Jhelum Vy. near Domel, "in great profusion," MacLeod 1891, Tawi Vy. 3500', Gammie 1891.

PUNJAB: *Chamba*—Ravi Vy. 4000', McDonell; *Kangra Vy. Dist.*, Mr. D. MacDougall, *fide* Trotter.

N.-W. P.: *D. D. Dist.*—Jaunsar, Tons Vy. 3000', Gamble; The Dún—Vicary in Herb. Hort. Saharanpur; Duthie 1882; Johri, near Dehra, 2600', Hope 1889, 1891; *T. Garh.* 3000', Mackinnons 1879; Sahlra 7000', Tons Vy. 4000', Gamble; Ganges Vy. 4-5000', several stations, Duthie 1881-83; *Kumaun*, near Banna 5500', S. & W.; 2-5000', many places; "19-7-49, Hydroglossum," Herb. Hort. Sahar.; Davidson, Duthie, Hope, Trotter, MacLeod.

DISTRIB.—*Asia*: N. Ind. (Him.) Sikkim and Bhotán 2-7000'. S. Ind.—W. Mts. rare, *Beddome*. Ceylon. Java. Philippines. China—Hongkong. Japan. N. Australia.

Clarke says this plant differs very little, in his opinion, from *L. flexuosum*, and Beddome that it is probably only a form of *L. flexuosum*. Why not *vice versâ*? I see marked differences, and do not see the probability suggested. The rhizome is distinctly creeping, though perhaps slowly, and branching; I have not seen *L. pinnatifidum* with that habit.

[ANGIOPTERIS *evecta*, Hoffm. In the Saharanpur Herbarium are two specimens of this, contributed by Dr. King, one of which is ticketed "Hindu Koh," and the other, from the Dalzel Herbarium, "Lahore"; but I think it best not to give this as a N.-W. Indian species. In the '*Synopsis*' is noted, under *Angiopteris*, *Psilodochea salicifolia*, Presl., as "an entirely obscure plant, supposed to have been gathered in Lahore, said to be like *Angiopteris*, but without an involucre." I do not understand Beddome's entry—"Throughout the Indian region up to 7000' elevation." Clarke only says—"Round Bengal, alt. 0-7000', from Nepál to Bhotan and Chittagong."]

1. **O. lusitanicum**, L.; Syn. Fil. 445. *O. vulgatum*, L., *var. Aitchisoni*, C. B. Clarke in 'Review' 586.

AFGHAN.: Kurram Dist, "on the shingle plains, at an altitude of 5000'; August", Dr. J. E. T. Aitchison, No. 454, 1880.

PUNJAB: *Rawalpindi* and Hurroo Bridge 2400', Aitch. C. R., and in Herb. Hort. Sahar., 1882; Salt Range—Tilla Mt., and Rhotas, Aitch. 1872-74, in Herb. Hort. Sahar.

Mr. Clarke's description of his *O. vulgatum*, var. Aitchisoni, is:—"Rhizome elongate, bearing annually 4—10 fronds in succession, 2—2½ in. l. by ⅜—½ in. br., oblong, texture stout."

DISTRIB.—Europe: Guernsey: shores of the Mediterranean; S. France—Pau, *P. N. Fraser*.

Mr. Clarke remarks:—"There is no other *Ophioglossum* in the Herbarium" (Kew?), "nor any picture much like this: the rhizome appears to bear a

succession of fronds in one season: these are 1—2 fully developed, 1—2 young ones emergent, and several withered laminæ on the rhizome." The rhizome is "elongated" upwards, not horizontally. As I find this plant agrees with the figures given in Britten's 'European Ferns' for *O. lusitanicum*, I place it under that species provisionally, though I was at one time minded to make a new species of it—*O. Aitchisoni*. It appears to me quite unlike *O. vulgatum*.

Mr. Clarke remarks:—"A. Braun, in Seuber, Fl. Azorica 17, describes an *O. polyphyllum*; but this has venose fronds, the whole plant only 1—2 in. high, and comes from Terceira, and is probably not near *O. Aitchisoni*." A discussion regarding *O. lusitanicum*, L., and *O. polyphyllum*, A. Br., by H. C. Watson is to be found in "The Azores," by F. du Cane Godman, F.L.S., F.Z.S., &c., and in manuscript "Notes on the plants contained in the collection made by M. Drouet in the Azores in 1857," sent to H. C. Watson by Robert Shuttleworth, Ph. D., of 17th July 1871, which Mr. Baker has shown me, I find as follows:—"89. Although no *Ophioglossum* is in Drouet's collection, I have abundant specimens of the so-called *O. lusitanicum* of the Azores. This has nothing really in common with the true *O. lusitanicum*. I consider it a distinct species from *O. vulgatum* (under two of the forms of which Milde quotes it) for it is apparently widely distributed—Silesia (Milde). I have it from Arabia and elsewhere; and I have received it, or a similar species (which for the present, on account of an apparent midrib—false, probably—I have called *O. Reverchoni*) from the neighbourhood of Briançon (Hautes Alpes) in good specimens, but as being very rare."

2. **O. vulgatum**, L.; Syn. Fil. 445; C. B. 568; Bedd. H. B. 464.

PUNJAB: *Chamba State*—Kantli, 12 miles from Dalhousie 6500′, McDonell 1882; *Simla Reg.*—Hattu Mt. 8-9000′, Dr. G. Watt 1885 (Blanford in List); Bagi (Hattu Mt. ?) 9400′, Bliss 1891-92.

N.-W. P.: *D. D. Dist.*—Jaunsar, Thadyar 7000′, Rogers 1891, Bodyar 8000 Gamble 1894, Kathián 7000′, Gamble 1895; Mussooree—'The Park,' above 6000′, Mackinnons 1885, Hope—seen July 1892—too late in the season—station shown to me by V. Mackinnon; in the Dún—Kalanga Hill, near Dehra, 3000′, Gamble 1894.

DISTRIB.—*N. Amer.*: Quebec and Ontario southward to Florida and California; Kentucky, Tenessee, Texas and Arizona to Alaska. *Europe*: Lapland, British Isles and almost all other countries to Caucasia. *Asia*: N. Ind. (Him.) Sikkim 2-4000′, Anderson, Clarke, Levinge; Bengal—Chutia Nagpur, on Para-náth Mt. 2500′, Clarke Nos. 33823 and 33826. Japan, Sandwich Islands, Australia, N. Zealand. *Afr.*: Azores, Abyssinia, Guinea Coast, Angola, St. Helena, Zambesi Land, Cape Colony, Mascaren Isles.

I cannot make out the difference between *O. vulgatum*, L., and *O. reticulatum*, L., unless it be that the net-work of veins is fine all over the frond in the latter

named species, and in the former five only near the margins, the meshes in the centre being long and narrow. Anyhow, I can see no difference between the N.-W. Indian specimens and those I have gathered in Scotland, except that one of Gamble's plants from Jaunsar and another of his from Kalanga Hill in the Dún, both in my possession, have two fronds, one of them sterile. So also has a specimen collected by Dr. King, in the Teesta Valley, Sikkim, in 1876. Beddome, in Suppt. H. B., 1892, says he believes "all the Himalayan specimens are referable to *reticulatum*; I can see no difference in the venation." Why, then, does he favour *O. reticulatum*?

Genus 34. BOTRYCHIUM, *Sw.*

1. **B. lunaria**, Sw.; Syn. Fil. 447; C. R. 587; Bedd. H. B. 469.

AFGHAN: Kurram Vy., Shend Toi "profuse", 9-10,000', Aitch. 1879.

KASHMIR: West of Gulmarg, 9000', Aitch.

PUNJAB: *Simla Reg.*—Hattu Mt. 8-9000', Kamalhori Mt. 9-10,000', Dr. G. Watt 1885, *fide* Blanford.

N.-W. P.: *T. Garhwal*—Nag Tiba Mt. 9-10,000', W. Gollan 1881; Damda Vy. 10-11,000', Duthie 1888; *Kumaun* above Tola 12,000', S. & W.; Garbyang 12,000', Duthie. Also—N.-W. India, Jameson, *fide* Clarke in 'Review.'

DISTRIB.—*N. Amer.*: Greenland, Newfoundland, Canada, British Columbia; *U. S.*: New York, Lake Superior, Colorado. *S. Amer.*—Patagonia. *Europe*: Iceland, Arctic Russia, Livonia, Lithuania, and Caucasia; British Isles; Spain, Italy, Switzerland and Mediterranean Isles. *Asia*: W. Thibet, Falconer: Karakoran Range, 12,500', *Clarke*; N. Ind. (Him.) Sikkim—Lachen 10-13,000', Hk. fil. Kamschatka, Japan. Australasia—S. Australia, Tasmania, N. Zealand.

2. **B. ternatum** (Thunb.) *Sw.*; Syn. Fil. 448; Bedd. H. B. 110.

PUNJAB: *Chamba*—McDonell; *Simla Reg.*—Simla, "a little below 7000'," Blanford; Summer Hill, Collett, Chadwick Falls 6000', Bliss, "The Waterfalls," Bliss; Mashobra 75-8000', Bliss, Watt.

N.-W. P.: *D. D. Dist.*—Jaunsar, Bodyar, Mrs. Sladen 1880; Mussooree, 10-7-45, in Herb. Hort. Sahar., under *B. daucifolium*; 'The Park', 6800', Mackinnons 1885; *Kumaun*—Naini Tál, Levinge: *fide* Bedd. in Suppt. H. B., Bhim Tal, W. Ainslie, in Herb. Levinge.

DISTRIB.—*N. Amer.*: Nootka and Hudson's Bay Territory, Canada; *U. S.*: New England, westward to California, Washington, and southward to Florida. *S. Amer.*: New Grenada. *Europe*: Lapland, Spain (Pyrenees), Hungary. *Asia*: Siberia, Kamschatka, Japan; N. Ind. (Him.) Nepal, *Wallich* No. 49, Sikkim—*Clarke, Levinge*; *Centr. Ind.*: Mt. Abu, *Sir M. Grant Duff*. *Australasia*—Tasmania, N. Zealand.

Indian specimens of this form used always to be ticketed *B. daucifolium*, Wall. But I saw in Mr. Gamble's collection a specimen of Mr. Clarke's, got in Assam in 1886, No. 45827, named *B. daucifolium*, which seemed to me to be typical, and quite different from those others. About the same time Mr. Trotter told me that Mr. Bliss thought the Simla fern was not *daucifolium*, and on hearing that I also had doubted this, Mr. Bliss wrote—"I am very pleased to find

that, at last, some one besides myself has discovered that our Mashobra (Simla) *Botrychium* is not *B. daucifolium.*"

[Beddome, in his Handbook, gives *B. daucifolium*, Wall., as found "throughout the Indian region, up to 8000′ elevation;" but the only specimen in the Kew Herbarium from the westward of Nepál so named is one marked Kumaun, R. Bl. 49, "*an mera varietas*, Wall. 48?" But No. 48 of Walliche's catalogue is *B. lanuginosum*, Wall.

The other habitats of *B. daucifolium*, to which the specimens in the Kew Herbarium are referred, are Nepál, Winterbottom; Sikkim; Bhotán *Griffith*; Nilgiris, *Beddome* and *Clarke*; Anamalais, *Beddome*. Ceylon, *Gardner*. China—Yunnan, *Henry*. Japan. Samoa.]

McDonell's specimen of *ternatum* from Chamba is curious; it has two sterile segments at the base,—the fertile branch starting 1½ in. up. A Mussooree specimen I have from the Messrs. Mackinnon, shows the sterile and fertile branches on segments splitting from a common stipes at barely half an inch from the root stock,—the sterile one 7 in. l. by 7¾ in. broad, as mounted. The fertile branch has a stipes 10½ in. l., $\frac{5}{16}$ — $\frac{7}{16}$ inch broad, as pressed; frond over 6 in. l. tripinnate. Mr. Ainslie's specimen from Kumaun, in the Levinge collection in Dublin, I noted as being very lax in habit: sterile branch 13½ in. l. from the point of separation: fertile branch 24 in. l., much branching. In the same collection I noted a remarkable specimen collected by Mr. Levinge in Darjiling, alt. 7160′, 12-10-1882, of which the fertile branch starts at 3 inches from the rhizome: the sterile spike (or the frond) then curves to the right (as mounted), and ¾ in. higher up throws off to the left a fertile branch with a thick stipes, which 1½ inches higher splits into two fertile, branching, segments of equal length. I believe Professor L. M. Underwood says that what I call *B. ternatum* is *B. obliquum*, Muhl.

3. **B. virginianum**, Sw.; Syn. Fil. 448; C. R. 588, including β. *lanuginosum*, Wall.; Bedd. H. B. 471, including *B. lanuginosum*, Wall.

PUNJAB: *Hazára Dist.*—Kagán Vy. 8000′, Inayat, collector from Hort. Sahar. No. 20388 (Herb. Number); *Chamba State*—McDonell.

N.-W. P.: *T. Garh.*, Datuni 7000′, Gamble 1893, No. 24848; Murári 8000′, Gamble 1894, 24886; Duthie 1898.

DISTRIB.—*N. Amer.*: New Brunswick to Florida, and westward to Arizona and the Pacific Coast, *fide* Underwood. *S. Amer.* Ecuador and Brazil,—*fide* '*Synopsis*'. *Europe*: from Norway to Austria. *Asia*: N. Ind. (Him.) Sikkim—Rungbee, King 1878; marked "abnormal form."

I give this species as new to India, because I have no distinct recollection of King's Sikkim specimen, noted above; and, besides, that specimen has not been recorded. While I was at the Royal Herbarium, Kew, in 1888 or 1889, along

with Mr. McDonell, I detected the Chamba specimen in his possession; and since then a few other specimens have turned up. Instead of making this a variety of the common Indian fern, *B. lanuginosum*, Wall., I bow to authority, and give it as *B. virginianum*, Sw., because the fertile segment of the frond separates just below the base of the sterile part, and the cutting is sharper than in *B. lanuginosum*, and the texture is not woolly. It is one of the rarest of Indian ferns.

Now, in finally revising this article, and having had the advantage of studying well authenticated specimens of the American plant, I am all the more satisfied that it is quite distinct from Wallich's *B. lanuginosum*; but I am not so sure as I was that the above noted Indian specimens are the same as the American plant. More material is desirable.

4. **B lanuginosum**, Wall. Cat. 48. *B. virginianum*, Sw., β., *B. lanuginosum*, Wall. Syn. Fil. 448; *B. virginianum*, Sw., C. R. 588 (*B. lanuginosum*, Wall., given as a synonym.) *B. virginianum*, L. (under *Osmunda*), *var. B. lanuginosum*, (sp.), Wall. Cat. 48, Bedd. H. B. 471.

PUNJAB: *Chamba State*—McDonell, in List; *Simla Reg.*—Simla: not uncommon, Hope, Blanford, Trotter, Bliss.

N.-W. P.: *D. D. Dist.*, Mussooree, in various places, 45-7000′, Duthie, Mackinnons, Hope, A. Campbell; *T. Garh.*—Jumna Vy. 6-7000′, Duthie near Sainjni, 5000′, Gamble 1898; *Kumaun*: Wallich; Gajur Pass, Davidson; Naini Tal 6000′, Hope 1861; Almora 5-5500′, Madden, S. & W., 1848, Hope 1861; between Dandihâth and Karéla 5-6000′, Duthie 1884; 6-8000′, "common", MacLeod 1893.

DISTRIB.—*Asia*: N. Ind. (Him.) Nepal, *Wallich*; Sikkim and Bhotán common, *Clarke*; Assam—Khásia Dist., 4-6000, very common, *Clarke*; Manipur 5500′. S. Ind.—at the higher elevations on the W. Mts. Ceylon—above Newera Elya. China—Yunnan and Hupeh *Henry*; Yunnan *Hancock*.

The distinctions between *B. virginianum* and *B. lanuginosum* are thus stated by Beddome:—"In the typical American plant the fertile branch arises from the base of the sterile portion, and the latter is quite glabrous: in the Indian plant the fertile branch always springs from well above the base, and the sterile portion is more or less hairy." These two distinctions being, with rare exceptions, coincident, are corroborative evidence of permanent and, I should say, specific differences. I see a few soft hairs on some specimens of *B. virginianum*, but nothing amounting to wooliness.

Clarke refers to Milde's monogram on *Botrychium*, and to his Fil. Europe, 191-209, in which that author divides the genus into two main sections, *viz.*, (1) Cells of the epidermis straight: (2) Cells of the epidermis flexuose; secondary pinnæ of the lowest pair of pinnæ anadromous; and he (Clarke) says that the second section contains *B. virginianum* (the American type plant only); the first section comprising, among other species, *B. lanuginosum*, Wall., which Milde and Prantl both hold to be a good species,

one character being the catadromous secondary pinnæ at base of a sterile segment. Clarke finds that all the Indian material he has seen seems one species, with straight epidermis cells; but he can make very little of the anacata-dromous distinction. Milde finds both sets of plants in the Himalaya, and reckons them very distinct species. After examining all the specimens of *B. lanuginosum* in Gamble's and my collections, I find that a decided majority is catadromous, but one specimen is anadromous on one side, and has pinnules exactly opposite each other on the other side. I think with Clarke that this distinction may be disregarded,—the more so that it is not needed.

B. lanuginosum varies very much in size, cutting, and habit. I have a specimen from a little below Naini Tál with stipes 4 in. and frond 5 in. l. by 6 in. br., and another from the hill north of Almora, grown in open pasture—mounted on two sheets, though minus the upper third—the lower pinnæ of which are 10—11 in. l. by 6—9 in. br., as mounted. The next higher pair of pinnæ are $7\frac{3}{4}$ and 9 in. l. by $3\frac{1}{2}$ in. br. The fertile spike is about 8 in. l. with lowest pinnæ $3\frac{1}{2}$ in. l., tripinnate like the rest of the frond. A large frond, also from Kumaun, *Davidson*, is much more compound, and may almost be said to be quinquepinnate. I look upon the sterile part of the plant, taken together with the stipes, as the frond, and would not talk of it as a segment. It is a regularly pinnate frond, and the fertile spike is an extra branch or pinna, which does not interfere with the symmetry of the frond in other respects. I am confirmed in this view of the structure of the plant by finding in Gamble's collection a specimen from Ootacamund, in the Nilgiris, which, besides the usual fertile pinna (in this case as in all Mr. Gamble's Nilgiri specimens, taking off above the second lowest pair of the frond), has a small fertile pinnule on one of the lower pair of pinnæ taking off above the lowest pair of secondary pinnæ or pinnules. Another curious specimen in Gamble's collection from Mysore 5000′, "coll. W. A. Talbot," No. 3087, 1893, has two fronds springing together from the same root, about equal in size, and perfectly normal, each with its fertile spike. My large specimen from near Almora has some sori on the sterile pinnæ, one cluster of six on the fourth pinna from the base, and several others here and there. I think a similar case was mentioned lately in the Journal of Botany with regard to another species of *Botrychium*. *B. lanuginosum* has a thick rhizome and thick, fleshy roots, and is a terrestrial fern; but, like various other plants of the Himalayan forests, it is sometimes found growing in the clefts of branches of trees, sometimes high up. I have two specimens from Assam which are quite glabrous.

SNAKE-BITES AND POISONOUS FISHES.

By P. W. Bassett-Smith, M.R.C.S., R.N.

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From very early times there has been a common belief that certain people had a peculiar power of freely handling venomous snakes, and that a measure of resistance to the poison was acquired. Some of these "snake men" are not only described in old records as being immune to the poison, but also as having a remarkable influence over the snakes themselves; it was popularly supposed that snake blood flowed in their veins.

In present times it is well-known that some men exhibiting snakes in India frequently rub in small quantities of the venom on the back of one hand with the other, a small part being probably absorbed. In South Africa the Hottentots are said to eat the heads of poison snakes when killed.

Serpents were very generally worshipped by ancient man; their great beauty, grace of movement, and frightful power of causing rapid death by injecting venom, or by crushing, appealed strongly to the superstitions of the people, who either associated them with death or wisdom.

This serpent worship was almost universal, and is nowhere more prevalent than in India, where even in the present day the cobra is held in very great veneration, and it is never willingly killed by the Hindoos. In pre-Buddhist times, that is, about 600 B.C., the gods were represented with a canopy of five or seven cobras over them (Naja figures), and in the old cave temples very beautiful relics still remain showing these. In Southern India a single cobra is frequently represented alone. It is also one of the symbols of Shiva now.

In Egypt the old papyrus records show that snakes were divided into two classes; one, generally the cobra, being associated with divinity and symbolising wisdom; the second representing the malign influences and death, depicted as the serpent "Apep," the emblem of darkness, and the enemy of "Ra" the sun.

In China these beliefs take a more practical form, the concretions, etc., of snakes finding a prominent place as therapeutic remedies. Traditions of the same kind have been passed down from mediæval days to witches, etc.,—*vide* "*Macbeth.*"

Many curious powers are attributed to snakes beyond the mesmeric influence they exert over their victims before springing upon them. Thus a "krait" or species of *Bungarus* found in Scinde is called by the natives there "pyan" or drinker. This snake is said to suck in a man's breath when he sleeps, the result being that he dies at sunrise, with a swollen face, but no mark of a bite on him. No one will sleep on the ground for fear of the "pyan" in this district. The natives, however, admit that it can bite, but rarely does.

Venomous snakes are divided into two main classes—(1) Colubrine, (2) Viperine.

The Colubrine again into (1) Elapidæ, or land snakes.
(2) Hydrophidæ, or sea snakes.

The Elapidæ include—

(1) *Naja*, or Cobras found in India, China and N. Africa.
(2) *Ophiophagus*, or Hamadryads, found in India and East Indies.
(3) *Bungarus*, or "Krait," of India.
(4) *Hoplocephalus*, or Tiger snakes, etc., found in Australia.
(5) *Pseudechis*, or Black snake, found in Australia.
(6) *Acanthophis*, or "Death adder," found in S. Africa and Australia.
(7) *Elaps*, or "Coral snake," found in West Indies and Brazil.

The Hydrophidæ include—(1) *Hydrophis*, (2) *Enhydrina*, (3) *Pelamis*, (4) *Platurus*, (5) *Aipysurus*.

The poisonous Viperine snakes are divided into—

(1) Viperidæ, or true vipers.
(2) Crotalidæ, or pit vipers.

The most important of the former are—

(1) *Daboia*, or "Tic-polonga," "Russel's viper," of India and Ceylon.
(2) *Echis*, or "Fursa," of Northern India.
(3) *Cerastes*, or "Horned viper," of Egypt.
(4) *Pelias*, or "Common adder," of Europe.

Of the latter—

(1) *Crotalus*, or "Rattlesnake," of America.
(2) *Bothrops*, or "Fer de Lance," of W. Indies.
(3) *Halys*, of India.

GEOGRAPHICAL DISTRIBUTION.—Poisonous snakes are found in all tropical areas, except certain oceanic islands, and in most temperate ones, New Zealand being a marked exception.

Each region has, however, distinctive characters.

In Asia and Africa the cobras, hamadryads, kraits, and true vipers are most abundant.

In America the Crotalidæ.

In Australia the pit vipers are not at all represented. Krafft states that twenty-one innocuous and forty-two venomous snakes occur there, but of the latter only five are dangerous to man; these include *Hoplocephalus*, *Pseudechis*, and *Acanthophis*.

In South Africa, chiefly the Acanthophis, or Death adder.

In the West Indies, *Elaps* and *Bothrops*.

The *Mortality* from snake-bite in India is very high, being even now put down as about 20,000 annually, equal to about 1 to 10,000 of the population.

In Australia the death-rate proportionately is considerably less—probably, as Martin states, due to the people having a much better knowledge of what to do.

The most deadly snakes in India, according to Fayrer, being in order of severity of action—(1) Cobra, (2) Kraits, (3) Daboia, (4) Echis.

In Australia *Hoplocephalus curtus*, *H. superbus*, and *Pseudechis* are the worst. The sea snakes rarely attack man, though so common in Australia and waters of the Far East.

ANATOMICAL CHARACTERS.—The " true vipers " are distinguished by their triangular-shaped head and constricted neck ; the scales on the head are generally small, the loreals (scales between the nasal and anterior ocular) are almost always wanting. The pupil is vertical ; the fangs are tubular, large ; reserve teeth being present, but no others are found on the short maxillary bones ; the tail is rapidly attenuated.

The " pit vipers " have triangular heads, but with large scutes on the top ; otherwise as in the true vipers, the poison fangs are very large, the maxillary bones are small and very movable, and the tail ends in a rattle or hard spine.

The poisonous *Colubrine* have smaller heads of regular shape ; the scutes on the top are generally well-marked and regular ; the " loreals " are usually absent ; the maxillary bones are longer, less movable, and the fangs smaller than in the vipers, and they are grooved along the anterior border and not tubular. The pupil of the eye is generally round, and the tail gradually tapers to a point.

The *Hydrophidæ*, or sea snakes, have small heads, with the nostrils on the upper surface. The anterior frontal scutes and loreals are absent, the pupils are round, the ventral shields are usually absent, and the tail is flattened from side to side, the tongue is short, and the poison fangs are small and grooved.

The great distinction between non-venomous and poisonous snakes is that the former possess two complete rows of small ungrooved teeth on either side of the upper jaw, the outer row, twenty to twenty-four in number, being attached to the maxillary bones, the inner to the palatine ; when they bite, they leave characteristic marks.

In poisonous snakes the outer row is represented by one or more tubular or grooved fangs, firmly ankylosed to the maxillary bone, which is freely movable; this mobility allows the erection and depression of the fangs. The anterior is always the largest, the others, if present, being reserve teeth. When these snakes bite, they leave usually two punctures only.

The *Venom* is secreted by a compound racemose gland, which Gunther describes as being homologous with the parotid glands of mammals, having large alveoli which act as receptacles for the fluid ; these glands are placed behind the orbit above the angle of the mouth ; they are invested with a dense fibrous sheath, being also covered by the masseter muscles. The excretory duct passes forwards, opening into the base of the sheath of mucous membrane covering the fang, being here bent at an acute angle, so as to face the front border of the tooth, thus allowing the fluid to flow freely down the tube or groove as the case may be. When the snake opens its mouth to bite, the muscles act on the maxillary bones and erect the fangs ; as the jaw closes on the part bitten, the masseter and pterygoids compress

the poison glands so that the venom is forced down the duct into the tooth and injected into the wound. The firmer the hold obtained, the greater the quantity of venom injected, and the greater the danger.

Non-poisonous snakes also have rudiments of this gland, which secretes a poison not in sufficient quantities to be harmful, but sufficient to render them resistant to the toxic effects of other poisonous snakes when bitten. (Fraser.)

In 1896 Prof. Fraser asserted that the serum of poisonous snakes possesses antitoxic powers, and presumes, that this was acquired by the snake swallowing its own venom. Cunningham later disproved this, showing that the natural immunity of the snake is quite distinct from the artificial immunity, which is established in other animals as the result of continued cumulative treatment by cobra venom, and that it is unconnected with any material of the nature of an antitoxin. He found that cobra serum had *no* antidotal effect on Daboia venom ; he does not therefore believe that the immunity of snakes is due to the swallowing of their own venom.

The fact, however, remains, that most reptiles and amphibians possess a high degree of resistance as a natural property, quite independent of any process of self-protection. One of Cunningham's snakes readily resisted an amount of cobra venom enough to kill one hundred fowls, yet its serum had no protective power ; its blood indeed was highly toxic for one week after, enough to rapidly kill a fowl when injected.

The immunity of snakes to venom of other and the same species is not absolute though general, for I have seen a *Daboia russelli* in captivity attack a second in the same cage, which was found dead soon after. Also any one who has seen a fight between a bamadryad and a rat snake "Dhamin" of equal or larger size will remember the gradual poisoning of the latter, which nevertheless meanwhile inflicts much local injury on the less powerfully toothed but successful adversary. A species of *Bungarus* or "krait" of Scinde will kill and swallow the very venomous "fursa" or *Echis carinata*. Cunningham further believes that the degrees of susceptibility to some extent run parallel with the respiratory acquirements, the slow-breathing, hybernating reptiles and lizards having the greatest resisting power. The mongoose is remarkably resistant to cobra poison, requiring from 10 to 25 times as much venom per kilo as a rabbit to produce lethal effects. Elliot believes that the success of this animal fighting cobras depends on (1) its great agility, (2) its habit of "setting up" its fur, thus deluding the snake as to the vulnerable part. Its immunity is due to the habit it has of seizing the snake by the head, and often by so doing incising the gland with its sharp teeth, causing the venom to escape and be swallowed by the mongoose ; this would also reduce the possible amount to be injected down the fang. Then there is the inoculation of minute quantities of venom from repeated, but ineffectual, scratch-bites. In these ways a partial immunity, which is hereditary, is established, becoming lost in time if the animals be removed to countries where cobras do not exist.

Other creatures are slightly immune, as pigs and guinea-fowl ; the latter, according to Calmette, being to a slight degree protected by having large air sacs. It has lately been shown by Calmette and others that the resisting power to venom becomes greater the larger the animal ; thus it takes a much smaller dose of venom proportionally, volume for volume, to kill a rabbit than a dog, man being even more resisting.

Venom is obtained pure from the different poisonous snakes by either making them discharge the fluid direct into a watch-glass, this being assisted out by gentle pressure applied to the poison glands, the snake being held in the hand with its head directed away from the operator as described by Calmette ; or the venom may be obtained by causing the snake to bite at a watch-glass covered with gutta-percha, the fluid collecting on the under side. The venom should be taken from a fasting snake every two weeks or so. From a good-sized cobra about 2-3 c.cm. is the average quantity obtained by Calmette, after which he generally artificially feeds the snake.

The venom thus collected has much the same appearance in all snakes—a limpid fluid of yellowish colour ; from the cobra it is a faint yellow, that of the hamadryad being a golden yellow ; it has a slightly acid reaction and an average specific gravity of 1·050 ; a bitter taste is said to be present in the venom of the cobra, but not in that of the Daboia. When the venom is placed under the microscope, nothing should be seen except a few epithelial cells and perhaps some contaminating bacteria. When kept moist, it gradually becomes more acid and decomposes, forming a coagulum, the fluid remaining poisonous.

Venom, when dried at a moderate temperature, 20° C., forms reddish-yellow or brownish-yellow crystalline scales, or it becomes agglutinated into little masses like gum-arabic. When thus dried and kept in the dark, it retains its toxic powers indefinitely. The dried residue equals in weight about 20-30 per cent. that of the moist venom. If the venom be heated at once after collecting to a temperature of 100° C., its toxic effect becomes impaired, and also if it be exposed to light.

The poisonous properties of *all venoms* depend upon the presence of at least two distinct toxic proteids. These proteids are similar to other albumoses produced from albumens, which may have been obtained by

(1) Boiling under high pressure.

(2) Gastric and pancreatic digestion through the agency of a ferment.

(3) The direct vital activity of cells.

(4) By certain micro-organisms, as *Bacillus diphtherix, B. tuberculosis, and B. anthracis;* by means of a ferment in the case of diphtheria, but by the direct action of the other two.

The proteids of venom are elaborated by a process of dehydration of albumen, without the action of any ferment by the epithelial cells of the poison glands, the ultimate product stopping short at the albumenose stage, not proceeding to the production of peptones as occurs in all the before-men-

tioned, except the toxin produced by diphtheria. (Sidney Martin.) In all cases, however, these albumoses, though differing greatly in intensity of action, yet when gaining access to the blood produce certain toxic effects; hence the antitoxic principle which now underlies the treatment of snake-bite, etc. The poisonous properties of peptone are becoming much more recognized through the work of Prof. Wright and others; it is an important fact to deal with in the preparation of antitoxic and prophylactic serums.

It has been shown by Martin and Gavan Smith that when dried venom is heated, it separates out into an albumen coagulated by heat, 70°-80° C., and a filtrate non-coagulable at any temperature, its action being, however, destroyed by boiling.

It has been further shown by Calmette that the albumen thus coagulated out has little toxic power, but that the filtrate, when dialysed out in a current of sterile water for twenty-four hours, gives a solution which, on being dried *in vacuo*, forms a brownish amorphous powder forty times more toxic than ordinary venom.

The amount of the coagulable and non-coagulable proteids varies in amount and proportion in different classes of snakes; thus in the Colubrine there is a large amount of non-coagulable poison, in the Viperine there is a very considerable quantity of the coagulable; on this difference depends to a large extent the variation of the symptoms produced by individual snakes. This is nevertheless only one of degree, as the *toxic effects of the non-coagulable poison are very much the same in all*, acting principally on the nerve centres, producing death by paralysing the respiratory centre in the medulla. The coagulable proteid acts chiefly on the blood-vessels and heart, being a powerful local irritant.

Cobra poison, which, as before stated, is rich in the non-coagulable proteid, kills by producing asphyxia, the heart beating after respiration has stopped; hence the use of artificial respiration in the treatment.

Rattlesnake venom is rich in the coagulable proteid, producing disastrous effects on the blood-vessels and heart.

Australian snakes show a good deal of both, and have an intermediate action.

Sir Joseph Fayrer found that cobra venom killed without destroying the coagulability of the blood, whilst Daboia (viper) poison caused complete and permanent fluidity, the blood of the animals so killed being excessively toxic.

Cobra poison produces little change in the pupil, Daboia widely dilates; salivation is a constant symptom of the former, rare in the latter.

When experimenting with venoms, Calmette and others at Lille use only the non-coagulable proteid, by which means they get rid of the intense local reaction of the second proteid, and as the *chief* toxic properties are in the former, the physiological effects of the venom are better thus watched. He also at once mixes up the venoms of all his snakes, from the sum total of which he obtains his dried toxin for experimental purposes.

It has been found that the non-coagulable filtrate of all venomous snakes, whether Viperine or Colubrine, has, when injected, the same characters and gives rise to the same symptoms.

The rapidity of the onset and the severity of the case depends on whether the virus is injected direct into a vein or into the subcutaneous tissue. It is rarely absorbed by healthy mucous membranes, but Fayrer is strongly adverse to the practice of sucking cobra bites. Also recently ejected venom acts as a powerful local irritant when applied to the conjunctiva, and may be absorbed.

The question of absorption and the neutralisation of venom by the various secretions of the body is of great interest, having been specially studied by Prof. Fraser and Capt. Elliot, I.M.S.

Martin states that gastric digestion does not affect cobra or Pseudechis venom. Mitchell says it does that of the rattlesnake. Fraser found that snake venom introduced by the mouth was not followed by any bad results. This was either due to non-absorption, or the chemical changes produced there by the gastric secretions. The latter was disproved by finding that after removal it still retained poisonous properties when injected into the blood. He next found that by mixing bile with the venom it was rendered innocuous.

Elliot has since, by experiments on dogs, proved that after diverting the bile completely, venom given by the mouth was still innocuous, but that if introduced into the small gut, it was rapidly absorbed through an unbroken epithelial surface, causing death. He concludes

(1) That cobra poison can be absorbed through the mucous membrane of the small gut, though not so readily as when injected in the subcutaneous tissues.

(2) That some change is induced in the swallowed cobra venom before it reaches a rapidly absorbing surface.

(3) That though bile is powerfully antidotal, as proved by Fraser, yet it is not the only protective agent.

(4) That tripsin is very powerful in reducing the lethal properties of cobra venom. Martin states that *all* venoms are destroyed by pancreatic digestion.

The result of all venoms is at first to produce a rapid fall in the blood pressure, during which the animal may die; if not, the blood pressure again rises, going above normal, as occurs after the injection of toxic peptones. In cobra poisoning the blood pressure may remain high until the time of death, even during the asphyxial period; if artificial respiration is then efficiently carried out, convulsions are prevented and life may be saved.

Lauder Brunton and Fayrer concluded that, besides paralysing the reflex activity of the cord, the poison acts on the nerve endings in the muscles like "curare." In the poisoning by vipers and Australian snakes, the dyspnœa and fall of the blood pressure occur together; but though producing the same paralysis of the reflexes of the cord, they *do not* especially select the respiratory centre. In these cases, therefore, artificial respiration is usually of little avail.

The action of venom on the blood has been shown by Martin and Halford to cause a rapid destruction of the red corpuscles, the leucocytes being relatively increased in numbers, these very quickly degenerating, their vital activity being destroyed. Martin placed two small pieces of sponge antiseptically in the abdominal wall of a guinea-pig, one having been soaked in a neutral saline solution containing 1 per cent. of venom, the other in the solution free from venom ; œdema occurred around the sponge containing the venom. After five hours the animal was killed. Both sponges were withdrawn, hardened, and sections made from them. In the first, healthy leucocytes were only found at the periphery, broken down ones filling the interior ; in the second, the whole was permeated with healthy phagocytes.

Calmette, from his experiments, finds that the venom does not act directly on the nerve-cells of the brain, but on the leucocytes, and that it is carried by them to the bulbo-medullary centre.

The rapidity with which venom acts depends on

(1) The quantity injected.

(2) The rapidity of absorption.

(3) The condition of the snake at the time of the bite.

(4) The susceptibility of the animal ; the personal factor, as pointed out by Elliot, being very important.

A minimum lethal dose always takes a considerable time to produce its results, and, as the amount injected is generally small, there is frequently time to apply remedial measures.

Calmette gives the toxicity of venoms according to their virulence, based on the number of grammes of an animal killed by one gramme of poison, as

Cobra, 4,000,000.

Hoplocephalus, 3,450,000 (4,000,000 Martin).

Pseudechis, 800,000 (2,000,000 „).

Common Viper, 280,000.

Sir J. Fayrer believes that a full dose of venom from a cobra, hamadryad, krait, or Daboia is necessarily fatal. It is only in cases where an amount little above the minimum lethal dose has been injected that remedial measures are of any use.

The effects of Heat and Chemical Agents.—A temperature of 100° C., if prolonged, will modify or destroy any snake venom, even after the removal of the coagulable proteid.

A 10 per cent. sol. of caustic potash or soda, after being in contact five or ten minutes, diminishes the poisonous properties of the virus.

A 1 per cent. sol. of pot. permang. destroys one part of venom when in contact, but its action is unreliable.

Hypochlorite of lime, 1 in 60 of water freshly made up, destroys the venoms completely, as also does 1 per cent. of chloride of gold. The latter two are the only ones recommended by Calmette, and are generally accepted now as being the best.

SYMPTOMS.—These are very varied according to the character of the snake and the amount of venom introduced, but depending greatly upon the presence or absence of the coagulable proteid.

Cobra.—If the amount injected be very large, death may follow very rapidly as if from shock—due to paralysis of the cardiac ganglia. When introduced in smaller quantity, and slowly absorbed, it produces some local redness and œdema, with progressive weakness and general paralysis, but showing a great preference for certain centres, particularly those governing the tongue, lips, and larynx, causing inability to swallow and profuse salivation ; respiration is rapidly extinguished with or without convulsions, and finally the heart stops, the pupil is contracted but reacts to light, the urine is never albuminous. If the symptoms pass off, complete recovery is rapid. When the poison is injected in a maximum lethal dose, stimulation of the centre produces violent convulsions, especially respiratory spasms, followed by general paralysis and rapid death.

European Viper.—Very quickly after the bite there will be local pain and swelling of the part, with general prostration, feeble pulse, perhaps passing into a condition of semi-coma or delirium, with slight convulsions. Recovery is generally rapid, though local suppurations not infrequently follow.

Daboia and Indian Vipers.—In these there is marked local inflammation at the seat of the bite, with swelling of the limb, great pain and hæmorrhages. Violent convulsions soon set in, but not necessarily followed by general paralysis and death. The paralysis does not especially select out the respiratory organs as in the case of cobra poisoning. The breathing has a peculiar irregular character, being at first quickened, then slowed. Hæmorrhages from the mucous membrane are common, hæmaturia and albuminuria being almost always present. The pupils are generally dilated and insensitive to light.

Rattlesnake.—The symptoms following the bite of one of these snakes are much like those produced after a bite from the Indian vipers, except that the local symptoms are more marked, general symptoms of blood poisoning being after a short time evident. Recovery from an almost hopeless condition is sometimes extraordinarily rapid.

Australian Snakes.—In these, according to Martin, local pain and swelling of the part bitten is not generally severe. The constitutional symptoms come on from a quarter to half an hour after the bite, with faintness, drowsiness, and prostration, the pulse gets thready, respiration becomes slow, hæmorrhages and albuminuria are generally present, the comatose very condition gets deeper and deeper, respiration stopping, then the heart.

Sea Snakes.—Although all these are poisonous, they rarely attack man. I have seen scores taken by careless sailors on the north-west coast of Australia, etc., without any bad results. Several instances of fatal bites have been recorded, one having caused death in 1½ hour.

The most fatal period after all bites appears to be between two and three hours; more than 25 per cent. die between one and three hours.

TREATMENT.—When a person has been bitten by any snake supposed to be venomous, the first and very important measure is to prevent the entrance of the virus into the general circulation. As the part bitten is generally one of the extremities, this may often be done by applying a tight ligature at once between the part bitten and the trunk; the second point is to remove or counteract the virus as soon as possible, suck the wound to extract the poison, cut the part out or cauterise freely, then wash the wound well with hypochlorite of lime=800 parts of chlorine to one of lime, or inject 8-10 cm. of the same in the track of the bite; this destroys the venom *in situ*, neutralising that not yet absorbed, or a solution of chloride of gold would act equally as well.

Inject 10 to 20 c.c. of antivenine if obtainable into the subcutaneous tissue of the flank, or if general infection is marked give it intravenously; after this has been done the ligature may be removed. One should also promote warmth, stimulate the circulation, and carry on artificial respiration if necessary. If no antivenine is to be had, give stimulants freely.

Half the number of fatal cases are stated to die from fear, not having the heart at the time to apply any remedial measures (Krefft).

SERUM THERAPY.

The analogy between certain toxins produced by pathogenic micro-organisms, as diphtheria, tetanus, etc., and the products of snake venom, together with the effects that they produce on most mammals, led to the belief that some antitoxin might be prepared for the latter, which would give protection against the virus. In spite of the opinion of Sir J. Fayrer and others that any idea of finding a physiological antidote was utopian, it has to a great extent been actually accomplished: the preparation and dispersion of a most valuable antitoxin is now being carried on in large quantities by Professor Calmette of Lille and his assistants. There is also to be a special laboratory, under the care of Major Semple, to supply this antivenine on the spot for the use of India.[1]

History.—Sewall in 1886 experimented on pigeons. By very gradual and repeated injections of rattlesnake poison, he produced in them very marked resisting powers to that poison.

Cunningham, by experiments at Calcutta, found that though a fowl may be immunised against cobra bite by repeated injections of the virus, yet that it was not then protected from Daboia poison and *vice versâ*, in contradistinction to the statements of Calmette and Fraser, that an animal immunised to cobra poison was also immune from *all* other snake venoms—a doctrine quite contrary to Behring's law, "that the action of an immunising serum is specific."

Phisatrix, Bertrand, and Calmette advanced knowledge a step further. Experimenting with rabbits and the venom of vipers, cobras, etc., they found that not only were they able to immunise the animal itself, but they also

[1] This laboratory is now in active existence.

found that the serum of these animals had distinct antitoxic powers if administered within an hour of the injection of the venom, causing what would have been a lethal dose to be less so or non-effective.

Professor Fraser in 1895 administered large doses of cobra venom into the stomach of a cat, producing no poisonous effects on it; but the cat was found to be immune to the poison when given hypodermically, and that its blood serum had antitoxic properties. He also found that its kittens acquired protection through the milk supplied by the mother.

Snake men are believed to acquire a certain amount of immunity by the repeated inunctions of small doses of venom on the hand, or, in Africa, by eating the head of the snake—at least that is a common opinion held in South Africa. Captain Elliot, I.M.S., from his recent observations in India brings forward evidence to favour the following conclusions :—

(1) That "snake men" in India, as a rule, have no knowledge of acquiring any immunity, but trust to their own intimate familiarity with the habits of the snakes, or to the previous mutilation of them, by removing their fangs, or sometimes by producing an internal fistula from the poison gland into the mouth.

(2) That a *few* do practice swallowing venom or the inunction of venom into the limbs.

(3) That they confine their work entirely to the cobra, the Daboia being very irritable, uncertain, and not at all amenable to their charming.

Calmette has shown that the antitoxic properties present in the serum of animals immunised against venom are *not* due to the direct action of the antitoxin on the virus, but that it is exerted through the tissue elements of the animal. He next proved that by mixing the venoms of various snakes, including Naja Daboia and Hoplocephalus, etc., and removing the coagulable irritative proteid, using only the active toxin of the dialised non-coagulable form, he was able to produce an antitoxic serum (from horses) which immunised animals and man from lethal doses of *any* venom, although each snake venom has *per se* well-marked toxic peculiarities producing several and various local phenomena.

In 1898 Major Semple, R.A.M.C., Captain Lyons, I.M.S., and Staff-Surgeon Andrews, R.N., under the supervision of Professor Calmette by a very complete set of experiments demonstrated that antivenomous serum could be prepared from horses which had a very high antitoxic power; that its preservative action shows itself almost instantaneously when injected intravenously, but if injected subcutaneously, only after a period of one to three hours; that under certain conditions it acts as a vaccine. They also proved that the duration of immunity so produced is short; the greater the quantity of serum injected, the longer this immunity remains. Its principal characteristic was its rapidity of action and its efficacy against all venoms whether from Colubrine or Viperine snakes. They found that this antivenine is easily kept, as it does not lose its protective properties when heated to 140° F.

This antitoxic serum is prepared in the following manner. Injections over the shoulder were given to healthy horses subcutaneously of a solution of dialysed venom in increasing doses for a period extending over months, generally sixteen, each injection usually producing severe local reaction and abscesses. When the horse is sufficiently immunised, he is bled from the jugular, the blood is kept in a dark room for twenty-four hours, after which the serum is syphoned off, divided up into 10 c.c. bottles; these are sterilised at a temperature of 10° C. on three successive days, the bottles being kept in a dark room, as is necessary with all other antitoxic serums.

The serum is useless for therapeutic purposes unless it is able to prevent death in a rabbit when given intravenously in a dose of 1·5 c.c.

It was found that the antivenine, like the toxin of the venom, is mainly carried by the leucocytes and not by the serum, for if the effusion from the peritoneal cavity of a vaccinated rabbit in which peritonitis has been excited be centrifugalised, the leucocytes which are deposited are found to possess a high antitoxic power, while the plasma has but little.

If the antitoxic serum be heated above 68° C., it becomes coagulated and is useless.

The practical results of the late investigations may be thus briefly stated:—

(1) That the injection of a sufficient dose of antivenomous serum (10 to 20 c.c.) prevents the toxic action of a lethal dose of venom given *later*, as would occur frequently when a ligature was applied above the bitten part at once, the venom having been kept out of the general circulation until after the patient had been injected with the serum.

(2) That the injection of a sufficient dose of the serum prevents intoxication by a lethal dose of venom given subcutaneously *before*, provided too long an interval has not occurred, which would include those cases where a ligature was not employed, or had been imperfectly applied, so that the poison had gained access to the general circulation.

(3) That as the resistance of man to the toxic action of the venom is greater as compared with the smaller animals, a much smaller dose proportionally of the serum is necessary to counteract the toxin.

(4) That if the venom has been injected directly into a vein, the result is always fatal, unless the serum be injected intravenously before or at the same time.

(5) That the serum should be at hand in all districts where snake-bites are common, and that the inhabitants should be instructed in the advantages derived from its use; particularly as the amount of venom usually injected by the snake is little above the minimum lethal dose, an interval of one to three hours being in most cases allowable between the time of the bite and the injection of the serum.

(6) That when toxic symptoms are already present, the serum should be at once injected *intravenously*.

(7) That none of the ordinary precautions should be omitted even when the serum is available.

The following two cases show the efficiency of the serum treatment :—

One reported by Keatinge and Ruffler was that of a girl in Egypt bitten in the forearm by a snake believed to be a cobra ; she became unconscious almost at once, and when seen was cold and collapsed with imperceptible pulse ; 20 c.c. of antivenine were injected under the skin of the abdomen and three hours after 10 c.c. more ; from that time she gradually recovered. The second case is recorded by Rennie. A boy aged eleven in India was bitten on the right foot by a krait. In three minutes 8 c.c. of serum was injected into the subcutaneous tissue of the abdomen, hypodermic injections of pot. permang. being used locally. The boy made a good recovery.

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Poisonous Fish, Diseases and Injuries attributable to them.

The subject of poisoning by fish is one on which there is very little recent information of any reliable character. Many ill-effects in different parts are frequently put down to the ingestion or even handling of them. It may be stated, however, with certainty that these are more common in tropical than in temperate regions, no doubt due to the much more rapid decomposition of the fish in the presence of heat and moisture, and perhaps to the fact that as all animal life is more abundant in warm climates, so the increased competition in the struggle for existence has caused many fish to have developed peculiar organs having protective and poisonous qualities. The noxious characters, as far as man is concerned, may be divided into—

(1) Toxic effects produced by the poison contained in the fish itself when fresh.

(2) Toxic effects produced by the ingestion of fish undergoing putrefaction either before being swallowed, or under certain conditions after it has been a longer or shorter period in the intestinal canal.

(3) The introduction into the body of specific pathogenic micro-organisms through the agency of the fish.

(4) Cutaneous wounds produced by the special armament of certain fish.

(5) Diseases or growths produced by parasites of which the fish is the definite or temporary host. In the constant investigation of fish markets for zoological purposes, particularly in the Indo-tropical and Chinese regions, I have been much impressed by the large number of apparently dangerous-looking fish that are habitually sold, and the advanced stages of decomposition which some of them frequently present, yet they seem to be used for food by the poorer classes habitually.

There used to be an old rule in the Navy that scaled fish were wholesome and that fish without scales were not. This, however, is certainly not altogether correct, as many with large scales, as *Sphyræna*, *Pagellus*, etc., are at times markedly poisonous; others without scales, as the fresh-water *Siluroids*, are esteemed as excellent food.

As a matter of fact, poisoning directly due to the consumption of fish is very rare in the naval service, and also among well-to-do Europeans in tropical regions.

The toxic properties inherent in fish, as Dr. Günther pointed out, may depend on various conditions; some are only poisonous at certain stages of growth, others only at special seasons, as at the breeding time; again, others are apparently dangerous after they have been feeding on poisonous foods; thus most of those beautifully-coloured fish belonging to the families *Squamipinnes* and *Labridæ*, which frequent coral reefs and browse on the polyps of the young growing madrepores, etc., are generally considered to be dangerous; nevertheless, if these be properly cleaned before cooking, most may be taken with impunity. French medical officers have pointed out that

many fish at other times wholesome become poisonous in the breeding season, and every one knows that a spent trout or salmon is very liable to give rise to gastric disturbance if eaten.

The symptoms of poisoning due to fish fall into two distinct groups: (1) true gastro-enteritis with colic and high fever, probably due to a *bacterial infection*; (2) nerve symptoms, often commencing some time after the ingestion of the food, attended by constipation, and various forms of paralysis, etc., probably due to *intoxication from the alkaloid substances* produced during decomposition.

The following fish are credited with producing poisonous symptoms when taken fresh :—

(1) *Pagellus erykhrinus*, a "sea bream" common in Indo-Pacific waters, quoted as nearly causing the death of Quiros, the Spanish navigator, and also described as poisonous in Cook's *Voyages*.

Lethrinus mambo in the South Pacific is said to be poisonous when full grown but harmless when young.

Many of the *Squamipinnes* or Coral fish, as before stated, acquire poisonous properties from their food. These fish are generally gorgeously coloured, and are like butterflies in the aqueous gardens which they frequent.

Sphyræna, or "Barracudas." Their flesh is as a rule eaten with impunity, but two species in the West Indies are known to occasionally produce intense symptoms of poisoning—gastro-intestinal irritation with pain, vomiting, and diarrhœa, etc., followed by marked prostrations and, in a few cases, death from syncope. If the fish is unwholesome, Poe states that the teeth become blackened at the base, and natives say that if a silver coin placed on the flesh becomes black, the fish is unfit for food.

Some of the mackerels frequently cause gastric irritation; several species of *Thynnus* or tunny are stated by Günther to be poisonous at times—being red-blooded fish, they are liable to rapid decomposition. The *Carangidæ*, horse mackerel or yellow-tails, have a very bad name at the Cape of Good Hope as being poisonous, especially when they are old, *C. falax* being the most dreaded. Almost every variety of this genus may be seen in the market at Aden for sale. After eating poisonous *Bonito*, *Tunny*, and *Horse Mackerel*, the symptoms are those of mild gastric enteritis, with urticaria, giddiness, headache, vomiting, and diarrhœa, which may assume a choleraic form, ending in collapse and death.

Fish of the herring family are undoubtedly very frequently extremely poisonous. Günther gives the following list :—

Clupea thryssa, the sardine doré of the W. Indies, often causes a rapidly fatal issue. There is a saying that "if you begin at the head you never finish the tail." The symptoms are pain, prostration, convulsions, and unconsciousness followed by death, sometimes in a quarter of an hour, but generally in from two to three hours.

C. longiceps, *C. perforata*, *C. venenosa*, the three latter from the Indian Ocean, are all known to have caused intense purging and collapse.

C. humeralis of the W. Indies is stated by Day to have caused death in a few minutes.

The marine "cat fish" or *Siluroids* are as a rule too loathsome to ever be much used for food. They are invariably rejected, if caught, on board ship, but are, however, constantly seen for sale in the native markets. Most of the species of *Balistes* (file fish), *Tetrodon* (globe fish), and *Diodon* (porcupine fish) are rejected as being poisonous; they are foul feeders, or live on coral and other zoophites. Two cases are recorded by Sir John Richardson of acute poisoning from eating portions of the liver of a Tetrodon. One man ten minutes after eating it became very ill, with flushed face, swollen lips, signs of intense gastro-intestinal poisoning, followed by paralysis, laboured breathing, cyanosis, and death in seventeen minutes. The second man died in twenty minutes. The whole fish was not more than eight inches long. Many of the small kinds are constantly seen for sale in the Bombay market and elsewhere, those from brackish and fresh water being more wholesome than the marine varieties. Macoy states that in Australia nearly all cases of fish poisoning are due to eating *Arripis truttaceous*, one of the sea perch. This may be sometimes due to decomposition, but fresh fish also produce unpleasant results in some people, the symptoms being flushing of the skin, particularly of the face, headache, vomiting, and a transient eruption, generally followed by rapid recovery, but a few deaths have been noted.

Muræna punctata, one of the "sea eels," is stated by Russell to be poisonous if eaten. Mosso states that the fresh blood of eels possesses highly poisonous properties, due to the presence of ichthyotoxin, like the toxalbumens of vipers.

Mussels or other shell-fish, though quite fresh, will sometimes produce severe symptoms—nausea, vomiting, diarrhœa, syncope, numbness of the limbs, and eruptions on the skin, with occasionally swelling of the tongue and mucous membrane of the throat. Those taken from the open sea are generally quite wholesome, the poisonous properties being derived from the foul water from which they have been gathered.

(2) *Putrefaction of Fish.*—This is the most common cause producing poisonous symptoms.

It is generally due to the action of micro-organisms breaking up the proteid substances present into a number of chemical bodies, some of which are harmless, others being very toxic.

The proteids are first split up into albumenoses, and then finally into the animal alkaloids known as "Ptomains"; these latter were first studied in detail by Selmi, and since then by Breiger, Van Ermengen, Sydney Martin, and others.

From decomposing fish Breiger isolated the following substances: *Trimethylamine, Dimethylamine, Methylamine, Neuridine, Cadaverine*, and *Putrescine*; some, as cadaverine and putrescine, are but slightly toxic, others are extremely so, rapidly causing death.

All "Ptomain" poisons are characterised by the combination of marked nervous symptoms, with gastro-intestinal irritation, and a tendency to coma, in which the patient may die. There is also almost always a more or less prolonged period between the ingestion of the food and the onset of the symptoms, "the incubation period"; when this is present, the cause of the poisoning, according to Van Ermengen, is due to the presence of a special organism, *Bacillus botulinus*, this condition being known as Botulism. David describes an interesting instance of poisoning by red herrings. There were five cases, all in one family. Gastric symptoms and obstinate constipation commencing some days after taking the food, occurred in all, followed by local paralysis of parts, double vision, and diminished reflexes. In two the dysphagia was so complete that feeding by a tube had to be resorted to. The paraplegic symptoms lasted for months, but all finally recovered.

Breiger isolated an alkaloid named *Mytelotoxin*, which is not destroyed by cooking, from the liver of mussels taken from foul water; this produces acute symptoms like those of "curare" poisoning, affecting the motor nerves, being quite distinct from those toxins which induce the gastro-intestinal irritation symptoms.

The treatment of all cases of Ptomain poisoning is to clear the stomach and intestines of the irritating substances as soon as possible, to give stimulants with discretion to counteract the cardiac depression, and where there is profuse diarrhœa and much pain opiates will be required; for the subsequent paralysis, massage and nerve tonics. "Tinned fish" are very liable quickly to undergo putrefactive changes, especially in hot climates; if then eaten, they produce severe symptoms, diarrhœa, vomiting, and collapse in a few hours, which may last for days or prove fatal.

In tropical climates, where the intestine is so ready under slight provocation to increased secretion, congestion, or ulceration, one cannot be too careful in the scrutiny of all tinned fish to be used for food; it is from these that on board ship fish poisoning most commonly arises.

(3) *The conveyance of specific pathogenic micro-organisms to man*, by means of oysters, mussels, etc., unquestionably takes place, perhaps more often than is generally believed.

The spread of typhoid has been distinctly traced to infected shell-fish, and reported accordingly by many medical officers of health and others. It is not uncommon in certain well-known localities to find oyster beds on the foreshore, immediately below the outfall of a sewer, and I have had it *stated to me* by a "grower" that in these positions the oysters are fatter and better in quality than those from more open situations.

Bacteriological examinations have been made demonstrating the presence of *B. enteritidis* and *B. colecommunis*, etc.

Legislative measures for removing this evil have been over and over again brought forward, but so far ineffectually, the interference with the oyster

industry and restriction of the area for beds being strongly opposed by a certain section of interested persons.

(4) *Poison Wounds caused by Fish.*—Perhaps the most widely feared fish producing cutaneous injuries are the "Sting Rays," belonging to the order *Batoidea.* These have one or more sharp barbed spines attached to some portion of the dorsal surface of the tail; these may cause severe lacerations when incautiously handling the fish, or when stepping on them while half hidden in the sand. In the first case I personally came across, the pain was so intense that the strong, healthy man almost fainted. There is no poison apparatus connected with the spines, but they are like poison arrows, being coated with mucus from the surface of the fish, which has peculiar irritating properties. Another class of fish, the *Scorpænidæ*, are profusely provided with sharp spines on the opercular plates, fins, etc., which inflict irregular punctured wounds. Among the very dangerous fish are *Synancea verrucosa* and *S. horrida*, found in the Red Sea and on the coasts of Africa and India; in these species the dorsal spines are grooved, having small poison bags attached, the venom being injected into the wound by pressure. Injuries from this fish occasionally cause death (Day). The symptoms vary according to the amount of venom injected; they are local pain, increasing and spreading from the wound, with swelling of the part, lymphangitis and gangrene, attended with convulsions, delirium, and attacks of syncope.

Other very dangerous fish are the *Thalassophryna*, of which two species are known, one in the Pacific, the second in the Atlantic Ocean. These fish, according to Günther, possess as perfect poison sacs and tubular spines as any venomous snake. The poison sacs are attached to the bases of the opercular and dorsal spines.

In the "Weavers" *Trachinus*, common in European waters, the dorsal and opercular spines have deep double grooves, these being filled with fluid mucus, but there is no true poison apparatus. Wounds inflicted by them are followed by violent inflammation of the injured part.

Many genera of the "cat fish" tribe *Siluridæ* are excessively dangerous to handle, the dorsal and pectoral fins having very hard serrated bony spines, which may inflict serious wounds; in some of these fish glandular organs are found at the axils of the spines; the body is covered by an offensive tenacious mucus, which can readily inflict the wound. Great numbers are commonly eaten by the lower "castes" in India, they are therefore frequently caught; the fishermen immediately cut off the offending spines, it being rare to see a perfect specimen in the market.

Treatment of Wounds.—These should be enlarged and the blood allowed to flow freely, or the part may be ligatured above, and the poison removed by cupping or sucking the wound, then ammonia or spirits of turpentine may be applied, followed by fomentations, opium being given and stimulants as necessary. The wounds caused by the serrated spines of rays and cat fish almost always suppurate.

(5) *Fish may act as intermediate or definite Hosts.*—An example of the former is found in *Lota vulgaris*, which is commonly known to harbour the larval form of *Bothriocephalus lotus* (see Cestodes). Congers are said to be infested with hydatids. A curious case has been described by Dr. Batten, namely, the fixation of a species of *Lepcophtheirus*, one of the "Calegidæ" or fish lice on to the cornea of a fishmonger (which specimen he kindly sent to me). These semi-parasitic copepods are very numerous on many flat fish, moving about actively on the skin some time after the death of the fish. The saline condition of the ocular conjunctiva, with a certain quantity of mucous secretion, render this position particularly suitable for these parasites if accidently introduced. It is, however, very rare : I have never heard of or seen a second case. The parasite was successfully removed, vision not being impaired.

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MISCELLANEOUS NOTES.

No. I.—SIZE OF REMARKABLE TREES.

Mr. L. Augusto has kindly measured the great *Gouralr Chintz*—the Baobab—*Adansonia digitata* near the Custom House at Mora, Karanja (Bombay Harbour), and reports it to be 30 feet 5 inches in circumference at 4 feet from the ground.

G. MARSHALL WOODROW.

KELVINSIDE, N.,
GLASGOW, *January* 1903.

No. II.—NESTING NOTES FROM KASHMIR.

I have spent the past summer in Kashmir, and it may interest oologists to read a few notes I have made on the nidification of certain birds whose nests and eggs are almost or altogether unknown. During April and May I was in the Astor District. On the 29th April, at an elevation of about 10,000 feet, I saw 3 young Nutcrackers—*Nucifraga multipunctata*—hardly able to fly, so this bird must breed very early. I think, too, it probably has 2 broods in the year, as I found a nest, containing young, in Sonamarg at the end of July. During May I found nests of *Tinnunculus alaudarius*, *Tetraogallus himalayensis*, *Pica rustica* and *Cinclus asiaticus*, but I was too early for eggs of the last two mentioned. June, July and August I spent in Sonamarg and in the higher valleys in its neighbourhood. Sonamarg itself has often been visited by egg collectors, but the higher alpine valleys round it appear to have been but little exploited. It is in these alpine valleys, from 10,000 to 14,000 feet, that many new nests may be discovered, and the best time to visit them is from the 20th June to the end of August.

Mr. J. Davidson, in the *Ibis* for January 1898, gives a very interesting account of 'a Trip to Kashmir' in search of eggs, and to any one intending to come up here for this purpose, it would prove of the greatest assistance.

No. 369. *Tribura major* is common at Sonamarg, and its characteristic note (Tic-tic-tic) loudly proclaims the bird's advent in the latter part of June. It is never met in the forests, but frequents the outskirts and the low bush jungle in the open meadows. I found 3 nests in July, but only secured one clutch of eggs. The nest is a small cup of grass lined with fine grass, placed on the ground in thick herbage, and is difficult to find. The eggs, 3 in number, are pinkish white spotted finely with reddish brown, and average ·74″ × ·57″ in size. The bird does not appear to breed below 7,500 or above 10,000 feet.

No. 405. *Phylloscopus affinis* I found breeding plentifully during July in the Juniper scrub from 11,000 to 13,000 feet. The nest is globular, loosely built of grass, lined with hair and feathers and is placed from 6 inches to 2 feet from the ground. The eggs, three or four in number, are either plain white, or white spotted sparingly with cinnamon red. The plain and spotted eggs sometimes occur in the same nest. The average size of the eggs is ·62″×·47″.

No. 589. *Alseonax ruficaudus*.—This Flycatcher is not uncommon in the Sind Valley from 6,000 up to 10,000 feet, but its nest is extremely hard to

find owing to the bird's shyness, and it deserts it very readily. I found 3 nests in June of the usual Flycatcher type placed from 20 to 30 feet from the ground, in every case the nest was against the main trunk and resting on a small branch of the tree. The eggs (I secured but one clutch) are pale green, very faintly spotted at the larger end with reddish brown, forming a well-defined ring.

No. 644. *Ruticilla rufiventris.*—The Indian Redstart was quite common in the higher valleys above 10,000 feet, being most common over 12,000 feet. I found only two nests, both in July, one of which was placed on the ground between two stones near a stream; the other, also near a stream, was built in an indentation on the side of a large rock about 4 feet from the ground. The nests were cup-shaped, made of grass, lined with fine moss, some horsehair and a few feathers. The eggs, 3 in number, are buff in colour, speckled finely with red; the average size being ·80″ × ·57″.

I have read Captain Marshall's 'Notes on the Birds near Quetta' published in the Journal of 18th October last, in which he states that the eggs of this Redstart are pale blue in colour. In both the cases quoted above, I unfortunately failed to kill the bird off the nest, but I examined the bird through a field glass for over half an hour, and the same morning killed a pair of the same species which I was able to identify.

No. 651. *Calliope pectoralis.*—The nests of this bird, which I found, were at an elevation of about 11,000 feet. They were cup-shaped, made of grass, and placed on sloping ground under a tuft of grass or small bush. The eggs, 3 or 4 in number, are pale greenish blue, faintly spotted with reddish brown at the larger end. The bird breeds from the middle of June to the end of July.

No. 712. *Accentor nepalensis.*—The Accentor was breeding early in July at a height of 13,500 feet. I found 2 nests placed on the ground under shelter of rocks; they were cup-shaped, made of grass and moss, and lined with fine grass. In one nest were 3 fresh eggs, in the other 2 nestlings and one addled egg. I left the former to see if the bird would lay more, and on the following morning, on returning to the nest, found that the eggs had been broken, and only one of them was sufficiently whole to admit of being patched up. The eggs are large for the size of the bird, the average of the two eggs I secured being ·94″ × ·69″. They are pinkish white in colour, and plentifully speckled with red, chiefly at the larger end.

No. 758. *Propasser rhodochrous.*—I found two nests of this bird in the first week in August, at an elevation of about 10,500 feet. The nests were cup-shaped, made of twigs and grass, and lined with horsehair: they were placed 3 or 4 feet from the ground in bushes; the eggs, four and five in number respectively, are a bright blue, with a few large black spots, chiefly at the larger end. The average size of the 9 eggs is ·72″ × ·53″.

No. 787. *Fringillauda sordida.*—Large flocks of these birds are often seen in the Kashmir valleys during the spring migration, and it is one of the

commonest birds in the higher valleys near Sonamarg during the summer. They did not begin to breed till the middle of July, and I fortunately secured several nests at an elevation of 12,000 to 13,000 feet. The nest is made of grass, and lined with horsehair and a few feathers: it is placed in a hole under a rock, and the tunnel leading to the nest is sometimes as much as 2 feet long; in two instances the holes were like those made by a rat in open flat ground. The eggs, generally four and sometimes three in number, are pure white with considerable gloss, and are somewhat pointed at the smaller end: average size ·82″ × ·59″.

KENNETH BUCHANAN, MAJOR,
4th Sikhs.

SRINAGAR, *December*, 1902.

No. III.—NOTES ON A FEW CATERPILLARS OF INDIAN SPHINGIDÆ.

1. *Acherontia lachesis.*—A larva found in Poona in October 1898 had the ground-colour a bright gamboge yellow instead of green: this tint may have just been assumed preparatory to pupation as the insect was full-grown, but it did not cease feeding until 3 days after being found.

2. *Polyptychus dentatus.*—Hampson describes the larva as "green, with yellow marks down the back, outlined in pink, &c." Two specimens obtained in August 1898 and a third in October of the same year in Poona, had no trace of pink or yellow on the back which was of a uniform bright green, while the sides were dull green in ground-colour. Others obtained from eggs and fed on the same plant had the normal pink and yellow markings.

3. *Chærocampa theylia.*—Three forms of this larva are given in Hampson's book; I bred a number of the first of these here in Sadra last September. In my experience the brown colour was only assumed in the final stage and not always then, the larva being invariably green in the earlier stages and sometimes in the last stage also: the green had occasionally a pink tinge. The pupa very long for the size of the moth.

4. *Chærocampa celerio.*—My experience of this caterpillar does not at all accord with Hampson's description, *i.e.*, "Brown: a series of whitish ocelli with darker centres from 4th to 10th somites; horn and underside white." In September 1900 near Palanpur I found two forms: the first, of which I obtained several specimens, feeding on 3 different plants (one the grape-vine), was green, with *2 ocelli only*, one on the 4th, and a smaller one on the 5th somite. The second form, of which I obtained one specimen at Palanpur and have bred another this year in Sadra, was brownish purple in colour with numerous dark strigæ on the dorsal area, a paler broad lateral stripe, pale sub-dorsal line from 1st to 4th somites; 2 ocelli, as in the green form, on the 4th and 5th somites, the first and larger one being yellow with dark centre flecked with blue; legs and horn crimson. I do not profess to know much about Indian moths, but the perfect insect produced from both the above forms of larva

agrees with the description of *C. celerio* in Hampson's book, and is certainly the moth labelled as "*celerio*" in the Society's collection. It is, except *C. theylia*, about the commonest of the genus in the Poona District and in Guzerat.

5. *Protoparce convolvuli.*—In Poona, October 1898, I obtained 4 larvæ feeding on a species of wild convolvulus in which the ground colour was a dull grey-green thickly covered with brown strigæ: a broad lateral white line, the oblique stripes indistinct. Head brown with black markings, horn shining black above, yellowish below. Resulting pupa and imago typical "convolvuli." I also found the normal green form on the same food-plant in the neighbourhood.

A. H. MOSSE, LIEUT., I.S.C.

SADRA, *December* 1902.

No. IV.—NUMBER OF EGGS OF THE DABOIA (*VIPERA RUSSELLI*).

On the 5th March last, at Mahisa, in the south of this Agency, I killed a female daboia rather more than 4 feet in length which contained 55 eggs. I opened several of them, but in none was there any trace of the embryo.

I regret that I did not make fuller notes at the time, but so far as my recollection goes, all except 3 or 4 of the eggs which I counted were fully formed.

In this part of Guzerat the local name for this snake is "Chitar."

A. H. MOSSE, LIEUT., I.S.C.

SADRA, MAHI KANTHA, *December* 1902.

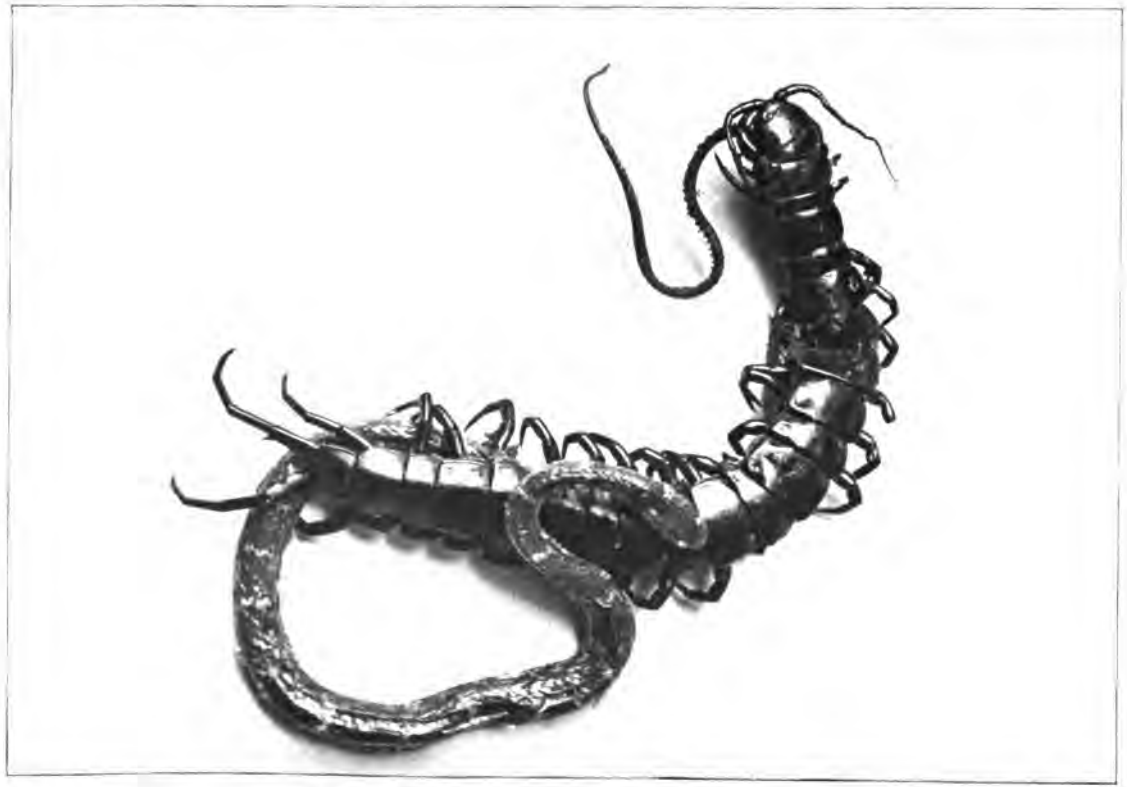
No. V.—THE INCUBATION OF A CUCKOO'S EGG.

At the end of August last year I found in Baroda a nest of the Large Babbler containing 4 eggs of its own, and a fifth of the Pied Cuckoo (*Coccystes Jacobinus*). When I blew these eggs the former proved to be comparatively fresh, one of them, only, containing just a tinge of blood, whereas the Cuckoo's egg seemed to have been sat upon much longer, the embryo being considerably advanced towards development and the eye-balls formed.

Now it is hardly likely that the intended foster-parents would take no notice of an egg deposited in the nest before any of their own had been laid; wherefore it must be presumed, I think, that at least one or two of the Babbler's eggs had been longer in the nest than that of the Cuckoo. The inference then is that the Cuckoo's egg incubates more quickly. If this is so, the object may be to enable the young Cuckoo to hatch before the others and either turn them out or from its superior age and strength obtain more than its fair share of food. Or the idea may be to give the Cuckoo a chance to make up for lost time if its mother is late in depositing her egg in the nest. These may be fanciful speculations on an isolated case, but I should very much like to know if anything of the kind has been noticed before? I have not heard of a similar instance.

A. H. MOSSE, LIEUT., I.S.C.,
Assist. Political Agent, Mahi Kantha.

SADRA, *December* 1902.



A CENTIPEDE EATING A SNAKE. Mintern Bros., Photo-Eng., London.

No. VI.—A CENTIPEDE EATING A SNAKE. (*WITH A PHOTOGRAPH*).

I believe it to be a fact that Centipedes in general are eminently raptorial in their habits, attacking anything that they can overpower. It never occurred to me, however, that a Centipede would be bold enough to attack a snake as appears to be the case in this instance. Considering the subject worthy of record, and possibly of interest to members, I had a photograph taken about half the real size, depicting the Centipede and snake in the position I saw them and in which I understand they were found.

The specimens were received by Dr. Pedley, who sent them home (unfortunately before they were identified) to his son for the Marlborough College Museum, and it is to him I am indebted for the following information.

They were found on the floor of a house at Kokine, a suburb of Rangoon, the snake alive and writhing in the clutches of the Centipede. They were killed and at once transferred to a jar of spirits, and the owner thinking the incident an unusual one sent the specimens to Dr. Pedley. An inspection of the photo will show that the skin and flesh for about two inches has been completely removed from the tail of the snake and presumably eaten by the Centipede, which was one of the common large brown unstriped variety often met with in this part of the province.

It would have been very interesting to know if the snake was uninjured before the Centipede attacked it, but in any case as the snake was alive when found, it might still have held its own against the Centipede. I shall be glad if this note and photo should prove to be of any interest to members of the Society.

W. P. OKEDEN.

RANGOON, *January* 1903.

No. VII.—A MAN-EATING PANTHER.

The panther first began man-eating in this district in the rains of 1901: apparently he came from the Dangs, as his first kills were in the villages bordering on those native states. I think he probably took to man-eating on account of the 1900-1901 famine which was very bad indeed in the Dangs, many people dying out in the jungle (I have myself seen skulls of those who tried to get into British territory but died by the way); during the famine the deer and pig in the forests would naturally diminish on account of the Bhils and Konkanis being hard up, and this together with the circumstance of people moving about in the wildest and least frequented parts in search of edible fruits and roots probably led the panther on some extra hungry day to take to man for food. The first man he took was probably dying or asleep in the jungle. I did not hear of the man-eater till last February when my camp was at Mulher in the centre of the valley where he was killing: his beat in the Mulher Valley was about 7 miles long and 3 broad. I remained 10 days at Mulher trying my best by means of "holding the hills," beats and sitting up over kills to get the beast, but was unsuccessful and

could not stay any longer. About a month later while I was in the Peint Range I received word that he was man-eating again, and so as the moon was waxing I determined to go back to Mulher and have one more try,—a long tiring journey of over 60 miles by road (with no springs) and 40 miles by rail. I stayed at Mulher a week, but never once saw the beast and had to go. Men were killed in August and September, and in November my work took me to Ajmir Saundana within 22 miles of Mulher, and while at Ajmir I heard on the 26th of November that the panther was killing again. I at once went to Mulher, but it was not till the 4th of December that the beast was killed; I should have had to leave on the evening of the 4th as I could spare no more time after him, so luck was with me at last.

On the 3rd, at noon, I heard a boy of 15 had been killed at Wadai, 4 miles from my camp; this boy was most unfortunate. Last year the panther had tried to get him, but only mauled one leg; my wife and I were able to dose the wound with carbolic oil and the boy got well; this time he and one or two others were sitting close to a bright fire on a threshing floor near the village in the early part of the night and the panther came and carried him off: the panther took him about a quarter of a mile to a patch of high grass and brushwood and ate all he could of the head, the flesh of one leg and all his inside; so there was plenty left for the beast to come back for. The body was dragged into deep shade under the brushwood and there was no tree anywhere near to sit up in, so four holes were made in the ground and a wooden post put in each; a cart was then taken off its wheels and lifted on to the top of the posts so as to be about 8 feet from the ground: the cart and posts were then hidden in branches and grass, only a small opening being left to shoot through. An avenue was cut through the brushwood so that I could clearly see the body from the erection, which was about 35 feet from the kill. At 3-30 p.m. I was sitting as quiet as a mouse in the cart and had sent all the men back to the village. At about 4-30 I distinctly heard the panther coughing about a quarter of a mile away. In another hour's time and without any warning the beast growled just *close* behind me; I had been absolutely still and he could not have seen me and so probably he scented me because of my erection not being far enough off the ground. I did not turn or move, hoping he would in a few minutes come round to the kill in front; but he was too cute, and it got darker and darker till at 6-30 I could not see the body at all: there was a crescent of a moon, but it was useless, as the body was in deep shade. At about a quarter to seven I settled to turn up my hurricane lamp and hang it outside on one of the front posts and about 7 feet off the ground: I did so as quietly as I could and the light shone well on to the body.

I now felt as if my best chance had gone, but settled to sit right through the night till morning. At 8-30, after the moon had set, when looking towards the body I saw a grey mass beyond it which had not been there before, so I knew the panther had come at last and was more thankful than I ever remember being in my life. He looked most weird as of course he

had come absolutely noiselessly, and he gradually got nearer and nearer and looked whiter and larger and more like a ghost than anything. When he got up to the body he half turned his side although still looking straight towards me, so I settled to shoot. I had purposely put an expanding bullet in the left barrel of my ·450 express and a solid one in the right and meant to shoot both barrels at once (a finger on each trigger) as the lamp invariably goes out with the concussion of the air so that one cannot get in a second shot. I aimed at his body behind the shoulder as far as I could and pulled both triggers; a flash, a loud report and total darkness, and then I listened and heard the panther crashing down the hill for about 5 seconds, then quiet, and then a groaning growl; so I knew he was hard hit. Nothing more could be done till morning so I went back to the village, and after a fine drink of milk tried to sleep on a bed of chaff thrown down on the ground under the eaves of a hut, but a rat which would try to walk over my face, numerous insects and cattle and goats a few feet away in the hut hardly allowed me a wink the whole night. At sunrise we started off to the kill: we found blood very soon and tracked very cautiously: the tracking was easy, as there was a lot of blood but there was plenty of cover so one had to be careful. The panther had gone down to the stream bed and after about 15 minutes we saw the body stretched out on some rocks ahead with back towards us. I threw a small stone towards it but there was no movement so I went up to within 10 yards' distance. I then was pretty sure he was dead, but threw a rock at him to make sure, when to my surprise he lifted his head to look at me. I fired two solid bullets into his head and all was over. He was a splendid male 7′·3¼″ long and the length of the middle toes in his fore feet showed he was the man-eater of last hot weather. One of the bullets of the night before had struck him in the stomach and the second (the solid one) had broken one of his hind legs.

When first he took to man-eating he would never touch any one unless he (or she) was lying down and unless it was quite dark with no moon or fire or light burning; under these circumstances if no one were sleeping outside he would go right into a hut if the door were open and lay hold of one of those asleep: if he happened to grip by the arm or leg and the victim yelled out then probably the panther would let go and try his luck elsewhere, but if he laid hold at once by the throat so that there could be no cry, then the man, woman or child would probably be carried out of the hut before the others sleeping near knew anything at all.

He had got bolder however lately and the kill before the last was in broad-day-light and I went and saw the place (in Gad forest on the Dangs boundary). Villagers had been cutting rosha grass and were taking their head-loads to the still, the last couple being a woman and her boy (or girl), who it seems were some way behind the others; the panther had crouched in high grass within 5 feet of a forest foot-path; I saw the patch of blood close to the path and some 10 feet from the grass where the panther must

have sprung from, and the marks showing the way the panther had dragged off the woman, but her remains were never found and nothing was heard of the child, so both must have been killed and eaten.

The following list shows the damage done by the panther in the Mulher Valley : he was probably the beast which did the man-eating in the Dangs and also in the part of the Pimpalner Range of Khandesh adjoining the Mulher Valley, but I can give no figures for damage outside the Nasik District.

Number of people killed at once 24
" " " who died subsequently from being mauled 6

Total deaths in Mulher Valley... ... 30

Number of people who were mauled but recovered, 11.

L. S. OSMASTON,
Deputy Conservator of Forests.

CAMP BHOWLI, NASIK DISTRICT,
January 1903.

No. VIII.—NOTE ON THE BREEDING OF CERTAIN HERONS, ETC. IN SOUTHERN INDIA.

In Hume-Oates, under *Herodias alba* (Vol. III, p. 238), is mentioned a resort near Madras where many waterfowl used to congregate for breeding.

On coming across this reference I decided to find out whether the place retains its old reputation in this way, and accordingly made inquiries last summer concerning it. The result of these inquiries was full of promise and I decided to visit the place, should I get an opportunity.

As soon as the N-E. Monsoon set in I communicated with Mr. A. C. Tate, I.C.S., Judge at Chingleput, who very kindly instituted searching inquiries for me.

The monsoon came late and the tank at Vaden Tangal remained empty until November 6th when heavy rain half filled it. The birds lost no time and appeared on the 8th. The villagers said it usually took thirty days for the birds to lay, dating from their arrival. I accordingly decided to visit the place about December 10th.

Happening however to be in Madras on duty at the end of November and with a couple of days to spare, I thought it would be as well to go over and see how the birds were progressing ; and well it was I did so.

I went over to Chingleput on November 30th and through Mr. Tate's excellent *bundobust* was enabled to spend a most instructive day on December 1st.

Leaving Chingleput at 5 A.M. in a pony *jutka*, a 13-mile drive brought me to within 3 miles of Vaden Tangal, which was reached in a bullock cart.

On arriving at the tank I found a raft prepared, and started at once to explore the nests. I found trees and tank exactly as described in Hume-Oates. I found only 5 kinds of birds breeding, *viz.*, 1527 *Phalacrocorax fusciollis*, 1553 *Anastomus oscitans*, 1554 *Ardea manillensis* (a few pairs only), 1555 *Ardea cinerea*, and 1568 *Nycticorax griseus*.

The natives, however, assured me that at this time there are usually 10 varieties breeding and that later on 3 more come. They gave me the Tamil names of these. With the exception of *A. manillensis* the birds were in thousands and I must have seen many thousands of eggs during the day.

At the bottom of page 239 of the article above quoted occurs the following passage:—"Can it be that any of the birds that breed in the South in December and January breed again with us in July."

That the birds are the same I am satisfied. *Anastomus oscitans* was, without exception, in grey plumage. I saw many specimens of *P. fuscicollis* with white breasts and saw many on the nests without the white tuft behind the ear coverts. Some specimens of *N. griseus* were in very bedraggled plumage, it being evidently their second brood, and the young of the first brood appeared to be with them.

Of *A. manillensis* there were perhaps 8 or 10 pairs, but these birds were so shy that I had great difficulty in identifying their nests, and only really managed to satisfy myself in one case.

I believe the sole difference between the nests of *A. manillensis* and *A. cinerea* is that the former have some pretence at lining in the form of rather smaller sticks whilst the latter have none.

A. oscitans kept entirely to themselves. *P. fuscicollis* and *N. griseus* did not appear to like each other, but appeared to put up with the 2 larger herons.

The eggs of *A. oscitans* were in all stages of incubation, the number of eggs in a full clutch being invariably five. The degree of incubation is perfectly easy to estimate from the amount of dirt on the shell, and in the same clutch may be found a perfectly white fresh egg and a dirty thing ready to hatch.

The young of *A. cinerea* are able to stand immediately on leaving the egg and it was interesting to watch them hatching. I saw birds that could not have been more than three or four days old picking vermin from each other.

This vermin appears like magic—there is no sign of it in the nests with eggs, which are of such construction as to give very little cover to insect life; but no sooner are the young hatched than they become infested.

The water in the tank is very oily and foul, and I was told that not even cattle would drink it.

If I had gone ten days later, I should, I think, have got very few full clutches and certainly no fresh ones.

H. N. PACKARD, Capt., R. A.

Ootacamund, *January* 1903.

No. IX.—QUEER FIND OF A PAINTED SNIPE'S EGG.

On 26th October last, Mr. H. A. Gass, Conservator of Forests, who was staying with me, told me that about a week before when he was dining with Mr. Jackson, I. F. S. at Coimbatore, the latter, when eating a snipe, came on

an egg. On inquiry the snipe of course turned out to be *Rostratula capensis*. Mr. Jackson kindly sent me the egg which he had kept. Although it was in a highly putrid condition when it arrived and had a couple of fork holes in it, I managed to clean it out and make some sort of specimen of it.

H. N. PACKARD, CAPT., R. A.

OOTACAMUND, *January* 1903.

No. X.—BIRDS NESTING IN SOUTHERN SHAN STATES OF BURMA.

The following notes may be of interest to some of our readers:—

Nos. 458, 459 *and* 461. *Suya crinigera* (THE BROWN HILL-WARBLER), *atrigularis* (THE BLACK-THROATED HILL-WARBLER) and *superciliaris* (ANDERSON'S HILL-WARBLER). The above three, according to Col. Rippon's List of Birds in the *Ibis*, October 1901, are all found up here, the last being stated as *very common*.—I have found a good many nests of Suyas up here, but so far have failed to identify the birds as they all seem very much alike with slight variations, some having a supercilium, others indistinct ones, and again some without any signs of one at all, while again some have black beaks and others horn-coloured ones, the size also varying.—I have sent four skins to the Society, which have so far I believe stumped even them.—I found one nest on 1st June 1902 with two eggs, the bird agreeing with No. 461, *Suya superciliaris*, the eggs being pinky white with dull red spots. I found another nest on the 19th with four eggs, the bird agreeing with the same description with the exception that it had *indistinct subterminal patches*, but the eggs are pale green with dull red spots and a zone round the larger end.—I have other eggs white with red spots and zones, in fact I have three distinct types of eggs, but, unfortunately, the birds all seem to merge into each other. The nests are all the same, cylindrical, of woven grass down with a hole at one side near the top. If any kind friend can help me out of my difficulty I shall be very much obliged. Egg collecting has its disadvantages in these parts when one is not good at identifying species and has no specimens for reference, although I have been very lucky in my first season in getting a good many comparatively speaking rare eggs.

No. 611. *Pratincola leucura* (THE WHITE-TAILED BUSH-CHAT). I saw three or four of these birds near Fort Stedman on the 29th July 1902, so they must evidently breed round the lake.

Uroloncha topela. This bird was first recorded from the Shan States by Col. Rippon in the *Ibis* for October 1901, being the first record from within Indian limits.—I sent skins to the Calcutta Museum for identification. Mr. Finn kindly wrote saying "they are certainly not the ordinary Munia (*U. punctulata*) of India, butwhether they are *U. topela* of China or *U. subundulata* of Burma, I cannot say." As it is highly improbable that two varieties are to be found up here, I think I am quite safe in recording its breeding from within Indian limits. It is extremely common up here during the rains, when it breeds from August to October (a few nests may be found in November). It nests at all

heights from the ground and not near water. It seems to prefer thorn and bramble bushes, the orange-trees in the Government Orchard being particular favourites. The nest is of the usual Munia type with a decided porch over the entrance. Five to seven seem to be the usual complement of eggs which are white. Fresh and incubated eggs are often found in the same nest but never more than seven.

I have lately received the following note from Mr. Oates in regard to *U. topela*:—

"The Munias you sent me are near *topela*, but not quite like the Chinese birds. If I were writing 'The Birds of India' again, I think I should unite *topela* to *punctulata*. The various races are so like each other and so difficult to make out."

No. 739. *Sporæginthus flavidiventris.* THE BURMESE RED MUNIA. Breeds up here from September to December. I have found nests at some distance from water in spear grass, the nest being very hard to find;—in fact the only way I have got them is while riding or out shooting by hearing the little bird get out with a "cheep" from under my feet. I have found two nests lined with feathers. As I do not see this mentioned in Blanford, it may be of interest.

Those nests found in September had five to six eggs, while those found in December had generally four incubated eggs; this is probably due to it being the second brood.

No. 820. *Hirundo striolata.* THE JAPANESE STRIATED SWALLOW. I have found three nests of this swallow in October and November but have not been fortunate enough so far to get their eggs, as some one destroyed the nest before I could get them. I watched one nest for some time and one evening I got up to it and feeling something inside opened it, catching both birds but alas no eggs. It builds generally inside houses, making a long retort-shaped nest, which must be broken before one can see into it.

No. 1236. *Circus melanoleucus.* THE PIED HARRIER. This Harrier must breed up here as I saw quite half a dozen of both sexes near Saga, south of Fort Stedman Lake, on the 10th and 28th July 1902. The country down there is a huge swampy plain with a river running through the middle of it. I had no time to hunt for nests nor did I want to, as the swamp is full of leeches, but I had a good opportunity in watching them from my boat, as they beat up and down on both sides of the river. The only eggs I got on this trip were the Striated Weaver bird and Chestnut-bellied Munia, of which there were any amount nesting in the long grass within a few inches of the water along the river banks.

H. H. HARINGTON, CAPT.

TAUNGGYI, BURMA, *February* 1903.

No. XI.—RARE DUCKS.

Mr. W. Moore has this year obtained three specimens of *Eunetta falcata*, one of which was sent to me for identification; all were young females.

Mr. N. S. Mondy has shot and given me a magnificent male *Anas sonorhyncha* (THE EASTERN SPOT-BILLED DUCK). The bird was one of three seen on the banks of the Brahmapootra River. Mr. Mondy believes he has seen others of this species before. This is the first recorded occurrence of the Eastern Spot-bill in really Indian limits.

Mr. Rose shot at the end of last year a fine male Pink-footed Goose, *Anser brachyrhynchus*. Messrs. Moore and Mondy saw two birds which, they *think* were of this species. The feet were of such a vivid pink as to attract attention when the birds were still far out of shot.

E. C. STUART BAKER.

DIBRUGARH, *March* 1903.

No. XII.—GAZELLE TAKING TO WATER.

The following incident may have interest for other members who, like myself, do not usually associate Gazelles with water :—

When riding on a camel early one bitterly cold morning, towards the end of January this year, along the bank of a wide and deep canal in the Hissar District, Punjab, I saw a Gazelle (*Gazella bennetti*) some little distance ahead on the same bank feeding along the grassy edge of the canal. When I came within some forty yards, it suddenly sprang into the water, and swam rapidly up stream for some distance ; then landed on a shelving part of the opposite bank ; scrambled up the side ; stood a few moments on top to look round ; shook the water off its flanks and then bolted off into a sandy waste beyond. It was a full-grown buck. I think he must have previously swam across the canal to feed on the short grass on the side I was moving. On this side, like the opposite, the country was perfectly open, so that if he disliked icy cold water, he could easily have avoided going into the canal to escape my approach. But he appeared to me to enter the water without the slightest hesitation, just as a Newfoundland dog would behave. A shikari who was with me, told me afterwards that the Gazelle constantly cross and re-cross the canal and its branches. In the part of the Hissar District I went over during a few days' stay, I noticed the Gazelle were nearly always seen not far from the canal and its irrigating channels, while what Antelope I came across, were miles away from water. The Gazelle appeared to keep near the gram fields ; and although these fields were protected all round by a high fence of thorny branches, they managed every now and then to jump over the fence, as on several occasions I saw them inside the fields. I was informed that when the hot weather sets in, the Antelope collect together and then keep near the canal and its water-courses.

G. S. RODON, MAJOR.

DHARWAR, *March* 1903.

No. XIII.—THE CRESTED GREBE.

It would appear that the Crested Grebe (*Podicepes cristatus*) is not at all uncommon in North-Eastern Assam. Messrs. Moore and N. S. Mondy have seen

nearly a dozen this year and secured eight. Mr. Stevens of Rangagora has shot one and I have had several notices of its having been seen by others. On nearly all occasions the birds are seen in twos, not necessarily pairs, as frequently both birds prove to be males, and females are much less often seen than males.

E. C. STUART BAKER.

DIBRUGARH, ASSAM, *March* 1903.

No. XIV.—FOOD OF THE HAMADRYAD OR KING COBRA.

Referring to Vety.-Major G. H. Evans' paper on the Hamadryad in Vol. XIV, No. 3, of this Journal the following note regarding the food of this snake may be of interest :—

While touring in the Trans Salween Shan States in February 1900, I shot a hamadryad in the Mè Hang stream. One of my men hung it up on a tree close by. After watching its contortions for a few minutes—for it was not quite dead—I was greatly surprised to see what appeared to be 2 or 3 inches of the tail of a snake protrude from its jaws ; this I immediately laid hold of, and extracted what turned out to be a cobra—a light-coloured variety in excellent preservation so that it could not have been long swallowed. The lengths of the hamadryad and cobra in the flesh were, respectively, 9 feet 8 inches and 4 feet. I procured the skins of both.

W. H. CRADDOCK.

KUALA LIPIS, PAHANG.
(FEDERATED MALAY STATES), *January* 1903.

No. XV.—OCCURRENCE OF THE COTTON TEAL (*NETTAPUS COROMANDELIANUS*) IN SIND.

When shooting at a dhund near Sujawal last week I shot a Cotton Teal. I see Oates in his "Game Birds of India" says that "this small duck has not yet been observed in Sind." My shikari said that he had seen the duck before, but that it was very seldom shot. The boatmen did not seem to know it. In case this may interest you I am sending the duck for identification.

J. W. PARRINGTON, LIEUT.,
47th Battery, R. F. A.

KARACHI, *January* 1903.

[NOTE.—There appears to be some doubt as to this teal occurring in Guzerat and Sind so that the above record is interesting. Blanford says in Vol. IV, Birds—Fauna of British India :—"In India this Teal is rare in Malabar, the Bombay Presidency and Kattyawar and wanting in the desert parts of Rajputana, in Sind and the Western Punjab." Oates in his "Manual of the Game Birds of India," Part II, says: "This small duck has not yet been observed in Kashmir, in Sind or in Cutch and probably these tracts lie outside its range." Stuart Baker in "Indian Ducks and their Allies," page 193, Vol. XI., of our Journal says: "In India proper it may be said to have its stronghold in Eastern Bengal, is still very common in Western Bengal

and Assam, less so in the Eastern Punjab and Rajputana, especially so in the cold weather, and actually rare towards the West of the Empire. Barnes says that it is not found either in Guzerat or Sind, but it has been recorded from both places since his book was written." Mr. Stuart Baker unfortunately does not say where it was recorded, so the above note of Lieut. Parrington's is interesting. In reference to Guzerat, Mr. E. L. Barton, of Bombay, writes: "On referring to my game-book I find—

On 17th January 1897 at Pardi (Surat District) I shot 5 Cotton Teal.
" 24th " " " " " " 1 " "
" 13th Feb. " " " " " 9 " "
" 18th Dec. 1898 at Lohderia (Ahmedabad District) I shot 1 Cotton Teal.
" 23rd " " " Abdura (Ahmedabad District) I shot 1 Cotton Teal.

I have shot, I am certain, many more Cotton Teal both in Guzerat and near Bulsar in previous years, but in my diaries then they were only put down as duck or teal."—ED.]

No. XVI.—FOOD OF *MELURSUS URSINUS* (THE SLOTH-BEAR OR INDIAN BEAR).

On the 6th March 1903 I wounded a bear which made off leaving a fresh blood trail. On following the trail fresh droppings were found and among them an entire snake skin about 15 in. long. The process of digestion had rendered identification impossible, and the scales were rubbed off, but the shape of the head was like that of a Russell's viper (*Vipera russellii*).

H. R. G. HASTED.

VIZAGAPATAM DIST., *7th March* 1903.

No. XVII.—*FELIS BENGALENSIS* (THE LEOPARD CAT).

About this cat Blanford remarks that there is one skin from the Coromandel Coast in the Calcutta Museum and a live specimen from Jeypore (Madras Presidency) was in the London Zoological Garden. From this it would appear to be rather uncommon in the northern parts of the Madras Presidency and I think it interesting to note that on 21st January 1903 one was killed in a beat in Jeypur State, Vizagapatam District, and that on 1st March one was caught in Jeypur District. The skin and living animal I have with me at present.

H. R. G. HASTED.

VIZAGAPATAM DIST., *7th March* 1903.

No. XVIII.—NOTES ON BIRDS NEAR QUETTA.

I notice amongst the Miscellaneous Notes in No. 3, Vol. XIV of our Journal, some notes on birds seen near Quetta, and would like to add a few that were obtained by me at or near Chaman in 1900 and 1901—

Aëdon familiaris,—THE GREY-BACKED WARBLER. In August and September in a garden and also near Sanzal.

Sylvia nana,—THE DESERT WARBLER. In the fort hills near Sanzal.

Scotocerca inquieta,—THE STREAKED SCRUB-WARBLER. Very common in the low scrub on the desert round Chaman.

Lanius assimilis,—THE ALLIED GREY SHRIKE. One specimen shot near Sanzal.

Oriolus kundoo,—THE INDIAN ORIOLE. Common in gardens. Mostly immature specimens seen.

Sturnus porphyronotus,—THE CENTRAL ASIAN STARLING. In Chaman in flocks in December.

Saxicola chrysopygia,—THE RED-TAILED CHAT. One specimen shot at Bogra in September.

Tharrhaleus Jerdoni,—JERDON'S ACCENTOR. At Chaman and at Saranan in January and March; at the latter place in small flocks in the bushes in the tanks.

Rhodospiza obsoleta (Licht). In Chaman in flocks in the gardens, in August and September and again in March, sometimes 20 or 30 at a time on railings and telegraph wires.

Passer hispaniolensis.—THE SPANISH SPARROW. In large flocks in gardens, &c., in October, November and December.

Emberiza schœniclus,—THE REED-BUNTING. Chaman, December.

Emberiza Stracheyi,—THE EASTERN MEADOW-BUNTING. One specimen obtained in Chaman in November.

Motacilla personata,—THE MASKED WAGTAIL. Fairly common in Chaman in the winter.

Anthus spinoletta,—THE WATER PIPIT. Common in lucerne beds at Chaman in winter.

Melanocorypha maxima,—THE LONG-BILLED CALANDRA LARK. On the desert in the winter. I kept one as a pet for some time which had hurt itself on the telegraph wires.

J. W. WATSON,
CAPTAIN, I.M.S.

POONA, *March*, 1903.

No. XIX.—NOTE ON *HIERAËTUS FASCIATUS*.

A pair of these birds visited our poultry yard for some months and accounted for 30 out of 40 (Bushire) chickens. I had long decided to shoot them, but their visits being at short intervals—sometimes in the forenoon, sometimes the afternoon—we were always taken unawares, and it was only when a commotion among the poultry announcing that another chick had been added to their list of victims, that we knew of their presence in the neighbourhood. Being shy birds, after securing their prey they were off as fast as wings could bear them and I only got an occasional glimpse at them as they were flying away, and concluded they were *Falco communis*, which are to be seen here occasionally.

A servant, who had seen the birds carry off a chick, when mentioning the circumstances, stated the birds first sat on the ground a short distance from

the hen with her brood, then made a sudden dash for a chick and carried it off. This trait being unusual for *Falco communis*, I asked whether the birds did not swoop down and strike the chicks; he said, no, they first sat on the ground and then attacked the chicks.

On the morning of the 6th January, I personally saw the birds attack a brood, which were under a clump of trees about 50 yards from me; both birds came to the ground first, then dashed in among the chicks, one of them being successful in securing a chicken, and though I ran forward shouting, it was not till I was about 15 yards from them that they flew off, settling on the ground again in the next field. I got my fowling-piece and went after them, but they would not now allow me within range, flying off and settling on the ground about 100 yards further off. After a careful stalk I got a long shot at the one with the chicken as it was flying away, causing it to drop its quarry. Both birds then made off for the hills close by. I went after them taking a Martini-Henry rifle, and as anticipated, the birds would not allow me within 200 yards, but flew from peak to peak of the cliffs. A lucky shot at 200 yards, with the rifle, broke the leg of one of the birds, it flew about 300 yards, settling on the ground behind a boulder, while its mate kept hovering near it. My servant fired at the latter as it flew over our heads, but missed. The report caused the wounded bird to fly off another 200 yards, coming to the ground again, when a tawny-coloured eagle gave it chase and caught it on the ground in its talons. The eagle pecked at the wounded bird two or three times, but was more intent on watching our movements. Hoping to secure both birds, I sent my servant forward to shoot them; but before he could get within range, both birds flew away, the wounded one settling again about 100 yards off and the tawny eagle kept hovering over it. My servant managed to shoot the wounded bird, which I recognised as "*fasciatus*." On dissection I removed two eggs, each about one inch in diameter. The bullet, with which the bird had at first been wounded, had apparently first struck the ground and then the bird, for only a part of it was found embedded in the hollow of the pelvis behind the femur. The pelvis itself was not injured, but the femur was shattered one inch below the joint.

This turned out to be the one which had secured the chick, for embedded in its toes were feathers from the chicken, which had been driven in by the shot when I first shot at the bird as it was carrying away the chicken.

This eagle was in fine condition weighing nearly six pounds, but her crop was empty. This together with the great cold had no doubt sharpened the birds' appetites, and hunger had made them less shy.

W. D. CUMMING.

ORMARA, MEKRAN COAST, *January*, 1903.

No. XX.—PREHISTORIC-MAN-HUNTING IN INDIA.

Not long ago Lord Kelvin in a lecture entitled *The Age of the Earth* gave the reasons which point to the period of time which has elapsed since

organic life first appeared on the earth as lying between twenty and thirty millions of years. Man, gradually evolved from tree-living ancestors, appeared comparatively recently upon the scene.

It has been shown in several ways that man existed during and before the last Glacial Period in Europe, by the association in many cases of his handiwork with the remains of extinct animals such as the woolly rhinoceros and mammoth which existed at that time as far south as the south of France, also by the occurrence of his weapons in the gravel drift in France and England at considerable depths, that gravel being now not in a river bed but in many cases at the tops of hills, showing that since that period the present valley has been formed—as for instance that of the river Thames in England and the Somme in France.

There is also the evidence as to age obtained from caverns in both countries, in which the implements were sealed up by silt, and the familiar stalagmite formation, which is deposited at a more or less fixed rate.

The date of the latest of the many Glacial Periods can be roughly arrived at not only astronomically by the alteration in the position of the earth's axis, but also geologically, and thirdly from the examination of the deposits in caverns, as for instance Kent's Cavern at Torquay between 1825 and 1841, by Mr. Godwin Austen in 1840, and six years later by the Torquay Natural History Society. But the final examination extended over twelve years and was supervised by a Committee of the British Association between 1868 and 1880. All three methods of computation are substantially in agreement. The implements in Kent's Cavern most resembling the Indian ones (which I have had the honour of discovering and presenting to the Bombay Natural History Society) are those in the lowest stratum of all known as the Breccia, a dark-red sandy earth holding quartz nodules, and not at all unlike the lateritic deposits in which the Indian implements are always embedded or out of which they are derived.

Very briefly this is the order of the Kent's Cavern Strata from the top:

(1) Blocks of limestone up to 100 tons.

(2) The *Black Mould* up to 1 foot in thickness.

(3) Stalagmite floor of granular texture up to five feet in thickness and containing limestone blocks.

(4) The Black Band up to 4 inches.

(5) The Cave Earth—a red clay less than 4 feet thick and in some parts absent.

(6) A stalagmite floor up to 12 feet thick.

(7) The Breccia.

By various methods of computation it seems that as long ago as 250,000 years man flourished in Europe, and therefore probably long before.

When I made my discoveries in Somaliland, during thirteen expeditions to that country, of stone implements at Jalelo on the Issutugan, of exquisite workmanship and in considerable numbers (three rather poor examples of

which are all I have been able to offer to the Society) and *the first ever found in Africa*, Sir J. Evans, the Treasurer of the Royal Society, in a communication to that body at once claimed them as paleolithic and as completing the chain of evidence linking India with Europe in prehistoric times. The types were *identically the same all* over the world. So much, then, as regards the age of Indian paleolithic implements. Of what kind were the men who used them? At the present day there are, I believe, no scientific men of eminence or at any rate hardly any, who do not accept the theories first propounded by Charles Darwin as clearly proved by overwhelming evidence all pointing one way. Man has *ascended* from the same root or arboreal ancestor as the anthropoid apes. His superior brain has given him the mastery, and given an upright position and the use of his hands, everything else has been shown necessarily to follow.

It is to be hoped that in India some caves may be found containing the remains of extinct animals, amongst which stone implements may be looked for, such as the caves at Bruniquel (Tarn et Garonne) and La Madelaine (Dordogne) in France; and those at Plymouth, at Brixham and in Yorkshire. We have not forgotten the recent discovery by M. Dubois in Java of part of the *cranium* and *femur* of an ape-like man or man-like ape (scientific opinion is divided as to what to call it) in Pleistocene deposits—named *Pithecanthropus erectus*; it was thought that the earliest discovered examples of the skull of prehistoric man were merely deformities and that their ape-like character was accidental.

Repetition has rendered this impossible. When the Neanderthal specimen was discovered not far from Dusseldorf in Rhenish Prussia its extraordinary appearance led some eminent scientists at first to regard it as a deformed specimen, until the subsequent discoveries in the caves of Eguisheim (near Colmar, Alsace), at Brüx (Bohemia) and at Spy (Namur, Belgium) and so on. A specimen was found as long ago as 1700 at Canustedt (Würtemburg).

That the Indian specimens which I have presented to the Bombay Natural History Society are at least as old as the lateritic beds in which they occur, is shown by the condition of the chipped surfaces which are stained in exactly the same way as the unworked quartsite boulders in the same bed. Some have been waterworn previous to becoming embedded and some washed out and waterworn afterwards.

H. W. SETON-KARR.

WIMBLEDON, LONDON, S. W.,
February, 1903.

No. XXI.—DROUGHT-RESISTING FODDER PLANTS FOR INDIA.

In view of the importance of this subject and the immense benefit which will result to India if some good drought-resisting fodder plants are introduced, the following note by Sir W. Wedderburn will be read with interest. *Atriplex semibaccata* appears to have proved to be a most successful fodder-

plant in California in places where the normal rainfall is small, and it is possible that in some parts of India, where similar conditions prevail, the cultivation of this plant will be found to succeed.

EDITORS.

DROUGHT-RESISTING FODDER PLANTS.

No. 2.

ATRIPLEX SEMIBACCATA ON ALKALI LANDS.

EXPERIMENTS IN INDIA.

The India Office has been so good as to supply me with the most recent information from India regarding fodder for cattle in times of drought. This information is contained in a Note (Agricultural Ledger No. 13 of 1901) by Mr. Moreland, Director of Agriculture, reviewing the attempts made to utilise the "reh" or "usar" lands, amounting to some two million acres, in the North-West Provinces and Oudh. The first important correspondence on the subject was published in 1864, No. 42, Government Selections, and deals with the deterioration of villages lying along the Western Jumna Canal. It shows that the construction of that canal, and the neglect of drainage works, led to the accumulation of injurious salts at the surface in such quantities as to destroy the fertility of the land, and render cultivation impossible. There is no record of attempts made to meet this mischief during the next ten years; but in 1874 the matter was taken up by Mr. (now Sir Edward) Buck, and in 1876 the "Reh Committee" was appointed, and a scheme of experimental work was drawn up, to include arboriculture, surface and subsoil drainage, flushing, manuring, and the growth of special crops. Unfortunately no chemical analysis appears to have been made of the soil selected for these operations; and the omission of this essential preliminary deprived the experiments of scientific value; while it led to action being taken in wrong directions as, for example, when nitrates and phosphates were applied to the "usar" lands, which are now known to be already charged (even to excess) with these nutrients.

2. The Reh Committee's experiments, directed to the reclamation of "usar," are reported under four headings: (1) Removal of salts; (2) Drainage; (3) Silting; and (4) Deep cultivation, manuring, and ploughing in green crops. (1) *Removal of salts.* This was tried on the Awa estate. The salts on the surface were scraped off before the rainy season, and in the following year the quantity of such salts was found to be decidedly less; but the subsequent history of this plot cannot be ascertained. (2) *Drainage.* Surface drainage was attempted, but the plants died, and this method was given up as a failure. Subsoil drainage with two-inch pipes was then tried, but was also held to be a failure, mainly on account of the prohibitive cost, and the experiment was abandoned. (3) *Silting.* By this method it was sought to form an entirely new soil by deposit on the top of the "usar," but it was found that this process was of very limited application, depending as it did upon a copious

flow of water, and a sufficient supply of coarse silt. (4) *Deep cultivation, manuring, and ploughing in green crops.* Some practical success was obtained in improving the texture of the soil and in dispersing the salts from the surface by growing green crops of rice and hemp, and ploughing them in; but the experiments do not seem to have been conducted on systematic or scientific lines. No analyst being available, the original condition of the plots was not known; and the ultimate results are not ascertainable, as, after some years of varied operations, the plots were either sold to private individuals or diverted to other purposes. Thus at Amraman, acquired in 1882, there was abundant ploughing and manuring; rice, barley, peas, maize, and millet were sown with varying success; but in 1892 the whole reserve was sold, and the improvement effected in the condition of the soil appears to have been lost. Similarly at Cherat there was no analysis to begin with, and the official reports differ as to the nature of the saline deposits. Eventually this reserve was sold to a Mr. Keventer, who utilised it as a dairy farm. At Gursikran and Juhi the operations took a different direction, and a quantity of hay was made from the natural grasses belonging to "usar" soil, principally the *Sporobolus arabicus*. The areas were enclosed, and the grasses grew in considerable abundance; but they died down after the rains; they did not stand drought; and the hay, which proved unpalatable and innutritious, was refused both by the Cavalry and Commissariat Department as being unfit for fodder. The unsuccessful attempts to introduce Australian salt-bushes as fodder plants are referred to by Mr. Moreland at page 453 of the Agricultural Ledger. The first trial was made in 1882, and the *Atriplex nummularia* promised to do well. But the beginning thus made was not effectively followed up, and the ultimate fact of the experiment is recorded as follows: "Unfortunately the further detailed history of these plants is not on record, but all have disappeared." Mr. Moreland adds that he has learned from Mr. Duthie, Botanical Director, that the failure of these plants was "due to their inability to live through the wet season when the surface of the 'usar' is slimy mud, and water often stands on it." This collapse of the experiment shows that in selecting the locality for plantation, due consideration was not given to the special characteristics of the salt-bush, which tolerates extreme heat and drought, but cannot endure heavy rain and a moist atmosphere. Owing to this unhappy error a great opportunity was lost. Judiciously planted on the arid waste, which is its proper habitat, the salt-bush might, in the droughts of 1897 and 1900, have proved the salvation of countless plough cattle, besides, as will presently be shown, solving the problem of "usar" reclamation.

3. From the above summary it appears that as yet but little progress has been made, either in propagating drought-resisting fodder-plants, or in reclaiming "usar" lands, "the problem which has been the subject of special study by the Agricultural Department for the last twenty years" (Agricultural Ledger, p. 415). From want of scientific method the Department

appears to have missed the clue to success which has been dextrously grasped by the experts in America. To use a homely phrase, two birds may in the present case be killed with one stone, for American research shows that by the propagation of salt-bush on dry alkaline waste a double benefit can be secured. On the one hand an abundant supply of nutritious fodder may be provided; while, on the other hand, the noxious salts will be removed, thus restoring the soil to fertility, and rendering it fit for canal irrigation. In the interests of Indian famine prevention every effort should be made to secure this double advantage. How this may be done can best be learned by reference to the facts ascertained by American experts, to which I will now refer.

AMERICAN RESEARCH.

4. On the suggestion of the Director of the Scientific and Technical Department at the Imperial Institute, I addressed the United States Agricultural Department at Washington, and by their courtesy have received the latest accounts of what has been done in America, as regards fodder plants on salt lands. Among the printed papers received are the following pamphlets, prepared at the Experiment Station of the Agricultural College and issued as Bulletins by the University of California :—

Bulletin No. 125—(May, 1899): "Australian Salt-bushes, Results of 18 years' tests : characteristics, propagation, and field tests," by Charles H. Shinn, Inspector of Stations ; and "Composition and Food Value," by M. E. Jaffa, Assistant Chemist.

Bulletin No. 128—(March, 1900) : "Nature, Value, and Utilisation of Alkali Lands," by E. W. Hilgard, Director and Chemist.

Bulletin No. 133—(August, 1901): "Tolerance of Alkali by Various Cultures," by R. H. Loughridge, Agricultural Geologist and Physicist.

Bulletin No. 140—(February, 1902): "Lands of the Colorado Delta in the Salton Basin," by Frank T. Snow, E. W. Hilgard, and G. W. Shaw ; with a Supplement by J. Burtt Davy, Assistant Chemist.

I have also received 12 pamphlets on forage plants, published at Washington by the United States Agricultural Department. Of these the following bear the most directly on the subject of drought-resisting crops :—

Farmer's Bulletin No. 108—(1900) : "Salt-bushes," by P. Beveridge Kennedy, Assistant Agrostologist.

Circular No. 18—(1899): "Smooth Brome-grass," by F. Lawson-Scribner, Agrostologist.

Bulletin No. 2—(1900): "Fodder and Forage Plants," by Jared G. Smith, Assistant, Section of Seed and Plant Introduction.

5. No one can peruse these detailed records of chemical and botanical research without being impressed by the persistency and scientific skill with which the experiments have been carried out, and the care with which results have been recorded. Under the direction of public authority a staff of

highly-trained experts have set themselves to deal systematically with the problems arising out of drought; experimental farms and laboratories have been at their disposal; and the rich harvest of facts and experience reaped by them contrasts painfully with the meagre results obtained in India by the inadequate machinery provided for similar investigations. The conclusions arrived at, so far as they bear on the subject of this Note, may be briefly summarised under two headings: (A) Chemical analysis; and (B) Botanical research.

6. (A) *Chemical Analysis.* By this branch of inquiry it is shown that the salts existing in alkali lands are made up partly of salts that are noxious to plant life, *viz.*, carbonate of soda, sodium chlorid (table salt), and sulphate of soda (Glauber's salt), and partly of salts which are valuable fertilisers, *viz.*, sulphate of potash, phosphate of potash, and nitrate of potash: that these salts are originally distributed in solution throughout the soil; and that by means of capillary attraction and evaporation they are accumulated on the surface, forming a crust destructive to most forms of vegetable life. (B) *Botanical Research.* On the other hand, by the experiments in this department, it is proved that certain fodder plants, notably the Australian salt-bushes, can live and thrive upon such alkali lands, absorbing large quantities of the noxious salts, while appropriating only a small proportion of the fertilisers. They also possess the valuable property of sharing with the hygroscopic salts the 10 per cent. additional moisture held in suspense in these alkali soils. Among these salt-bushes experience points to *Atriplex semibaccata* as most suitable for hot dry climates, being drought-resisting, prolific, and capable of producing abundant supplies of good fodder; and it is found that by continuous cropping with this salt-bush the excess of injurious salts is eliminated; so that the alkali lands may, by this simple process, become "profusely and lastingly" fertile for the growth of ordinary crops.

7. With reference to the origin of the alkali trouble, Professor Hilgard points out (Bulletin No. 128, p. 13) that the soluble salts in alkali soil have, like the soil itself, been formed by the progressive weathering of the contiguous rocks; that the salts in the upper 4 or 5 feet of soil are usually limited in amount; and that they are not ordinarily replenished in indefinite quantities from the lower strata. The salts move up and down within the upper 4 or 5 feet of the soil or subsoil, following the movement of the moisture descending in the rainy season, or when irrigated, to the limit of the annual moistening as a maximum, and then re-ascending or not according as surface evaporation may demand. At the end of the dry season, in untilled irrigated land, practically the entire mass of salts may be within 6 or 8 inches of the surface. The injury to vegetation is caused mainly within a few inches of the surface, by the carbonate of soda, which corrodes the bark near the root-crown, and by the sodium chlorid, which acts as an antiseptic, and arrests development. Carbonate of soda may however be neutralised by treating it with gypsum, which converts it into the sulphate, or Glauber's salt, which

is comparatively innocuous. Sodium chlorid (table salt) cannot be chemically neutralised; but it can be removed mechanically, by scraping the salt crust from the surface, or by "leaching," that is by drenching the land with water, which dissolves the salts and carries them away by a system of under drainage. These methods however have the disadvantage that they carry off the fertilisers as well as the noxious salts. A special warning is given against the bad habit of surface irrigation, which stimulates evaporation and "deep-furrow" is recommended, *vide* diagrams at p. 38 of Bulletin No. 140. It is also pointed out that mere flooding will not wash away the salts, as these soak into the ground at the first touch.

8. The verdict arrived at from the botanical experiments is emphatically in favour of the *Atriplex semibaccata* within its own proper habitat. Summing up his conclusions Mr. C. H. Shinn, Inspector of Stations, reports as follows: "This Bulletin (No. 125) shows that the California Station has been experimenting with salt-bushes for 18 years, that the tests of some species have extended over the greater part of the State, and that *Atriplex semibaccata* is the most generally useful species of all that have been planted, although others are worthy of cultivation.....It is seldom that a plant shows so much adaptation to differing circumstances as *Atriplex semibaccata*." At the same time he warns us that "it cannot endure too heavy summer rains, nor the moist atmosphere of many warm countries," though "within its own realm it is unsurpassed among the gifts of nature to the deserts and alkali wastes which cover so large a part of the earth's surface." In this view he is fully confirmed by Professor Hilgard and the other authorities above referred to. I may quote a few particulars as to the special merits of this plant. First, as to its power of resisting drought: "The total rainfall at the Paso Robles Station for the season of 1897-98 was but 3·24 inches to March; April and May showers brought this to 4·75.....By the 1st of April, the roadsides were brown and barren. On unirrigated land there was no green fodder-plant excepting salt-bush in the entire region. The growth of *Atriplex semibaccata* on this poor and arid soil was a revelation to every farmer. Seed sown in December, 1897, made a foot of growth by April 12th, branching and covering the ground. After being cut back for sheep feed, it made a second growth of 6 inches by the end of May, and was cut a third time before the end of summer," (Bulletin No. 125, p. 5). Similar reports for the same dry year (1898) came from the other stations. Thus, in the West Sacramento Valley, "the salt-bush grew from a few inches to 3 feet in diameter on hard, dry clay land where even weeds did not grow; and it volunteered from self-sown seeds in the hard road." Then as regards tolerance of alkali, the *Atriplex semibaccata* stands "extremely high," surpassing all plants of similar food value in its power of growth on land highly charged with alkaline salts. It is also hardy in respect of cold, remaining green late in the season, and withstanding a temperature of 14° Fahrenheit. Further the *A. semibaccata* is very prolific, self-sown seedlings springing up

freely; the fallen seeds, and subsequent seedlings, being protected by the low-spreading mass of the plant. Some individual plants have, in California, attained a diameter of 18 feet in one year, much exceeding in growth the parent plants in Australia. A very large amount of fodder is thus produced, and in one case a yield is reported of 30 tons per acre of green forage. The green forage can be easily handled and made into hay, a special merit of this variety being that it is procumbent, and the stems are tender and flexible ; whereas most of the other varieties of salt-bush being shrubby and erect, are only suitable for browsing. This hay has a high nutritive value, its protein content being twice that noted for wheat hay. Next to the salt-bushes the Chilean plant *Modiola decumbens*, of the mallow family, deserves attention as a means of removing salt from alkali land. It grows very freely, and is relished by cattle. Then there is the Tussock grass (*Sporobolus airoides*), which stock will eat ; and the various alkali weeds, such as the "Grease woods" (*Samphires*), and the Alkali grass (*Distichlis spicata*). Smooth Brome grass (*Bromus inermis*) is also highly recommended in Circular No. 18. "Its drought-resisting qualities have proved it to be the most valuable grass for dry regions where other grasses could hardly exist." I observe also that the Argentine salt-bush (*Atriplex pamparum*) is favourably noticed.

PROPOSED INDIAN RESEARCH.

9. Such being, in brief, the result of American investigations, there remains the question : What practical steps should now be taken in order to utilise these conclusions, and obtain for India the two-fold benefit, of abundant fodder for cattle, and the reclamation of "usar" land ? Before applying American experience to Indian requirements, care must be taken to ascertain how far the physical conditions of the two regions are identical ; and for this purpose it is necessary that the tests of chemical analysis, and botanical experiment, should be applied in India with the same scientific accuracy that has been employed in America. It seems probable that the salts, both noxious and nutritive, contained in the "usar" soil are similar to those in the alkali lands of California. But in order to proceed with safety an exact analysis should be made in the different Indian Provinces interested. If by such analysis phosphates and nitrates are found to exist in abundance, it will be evident that experiments with artificial manures and night-soil may be at once abandoned ; while the presence of carbonate will show that treatment with gypsum, or some analogous substance, is called for to neutralise the mischief to plant life. Then there is in India a wide field for botanic experiment, by reason of the varieties of soil and climate in the different provinces ; and with the large choice of forage plants offered by the continents of Asia, America, and Australia, there should be no difficulty in ultimately discovering the forms of vegetation best suited to Indian requirements. *Atriplex semibaccata* should have a prominent place in these botanical experiments, care being taken to avoid past errors as regards its location

Had heed been given to the warning of American experts, these plants, so peculiarly suited to hot arid plains, would not have been exposed to the wet and mud which caused their destruction in the experiment at Aligarh. [*N.B.* In this connection I see it stated that Lowland Purslane (*Sesuvium*) and Saltwort (*Suæda*) are suited to moist alkali and salt-marsh soils.] It has been ascertained that the ash of the *Atriplex semibaccata* contains 40 per cent. of sodium chlorid ; and it is calculated that the removal from the land of a five-ton crop of this salt-bush hay will take away nearly a ton of salt per acre. It would therefore evidently be a great mistake to plough it in, as has been done in the case of rice and hemp, for this would have the effect of returning the noxious salts to the soil. Mr. Moreland states that a further trial is being made of certain salt-bushes and allied plants. It would be interesting to know the names of these, and I trust *Atriplex semibaccata* is among the number.

10. The extended investigation above suggested are probably beyond the resources of existing expert establishments in India, which have done their best with insufficient means. But the practical issues are so momentous, that we must hope the Government of India, seeing what has been accomplished in America will not hesitate to equip Experiment Stations and Agricultural Laboratories on a scale similar to those at Washington and in California. It would be well to obtain the co-operation of the Indian Universities and Technical Colleges in organising the operations ; and in order that the work may be conducted continuously and at moderate cost, a staff of young Indian scientists might be permanently enlisted, to be specially trained for these investigations. Professor Bose and others have shown what valuable results may thus be produced in the various departments of scientific research.

11. It is gratifying that the Secretary of State has expressed his interest in drought-resisting fodder-plants, and has moved the Government of India to cause the subject to be taken up earnestly by the Agricultural Departments in all Provinces. The prospect is encouraging ; for every "usar" acre that can be planted with salt-bush, will provide tons of wholesome sustenance for cattle, while gradually bringing into culturable condition waste lands which are described as being "intrinsically of the very richest description."

W. WEDDERBURN.

INDIAN FAMINE UNION,
Palace Chambers,
Westminster, S.W.
1*st January* 1903.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 5TH FEBRUARY 1903.

A meeting of the members of the Bombay Natural History Society was held at the Society's rooms on Thursday last, the 5th February 1903; the Venerable Archdeacon Scott presiding.

NEW MEMBERS.

The election of the following new members was announced :—

Mr. H. C. Nangle (Rangoon); Lieutenant A. Willock, R.I.M. (Bombay); Mr. St. G. de Carteret (Partabgarh, Oudh); Mr. P. J. Fitz Gibbon (Belgaum); The Hon'ble Syed Hoosein Belgrami, Nawab Imud-ul-Mulk Bahadoor, B.A. (Hyderabad, Deccan); Mr. A. D. St. C. Barr (Amraoti, Berars); Mr. T. J. Metcalfe (Rangoon); Lieutenant J. W. Parrington, R.A. (Karachi); Mr. J. Scott, M.I.C.E. (Calcutta); Mr. G. Richards, P.W.D. (Rangoon); Mr. J. McKenna, C.S. (Bassein, Burma); Mr. J. A Chapman (Bassein, Burma); Major C. T. Robinson, R.F.A. (Mhow, C.I.); Major S. D. Browne, R.H.A. (Mhow, C.I.); Dr. Nassarvanjee Fakirjee Surveyor, M.D. (Bombay); Captain P. C. Gabbett, I.M.S. (Coonoor); and Mr. Samuel Joyce (Bombay).

The Honorary Secretary, Mr. W. S. Millard, asked members to try and induce others to join the Society, as the more members they could obtain, the better would be the position of the funds of the Society, and more money could be spent in improving the Journal.

CONTRIBUTIONS.

The Honorary Secretary acknowledged receipt of the following contributions since the last meeting :—

CONTRIBUTION TO THE MUSEUM.

Contributions.	Description.	Contributors.
Some specimens of Fishes from the Persian Gulf.	.....	Mr. F. W. Townsend.
1 Indian Pangolin or Scaly Ant Eater* (alive).	*Manis pentadactyla*.....	Mr. A. H. A. Simcox, I.C.S.
1 Skin of the Indian Chevrotain or Mouse Deer.	*Tragulus meminna*	Mr. R. E. S. Branson.
1 Skin of the Cotton Teal ...	*Nettapus coromandelianus.*	Lt. J. W. Parrington, R.A.
1 Skin of the Great crested Grebe.	*Podiceps cristatus*.....	Mr. H. Bulkley.
Three Stone Implements from the Madras Presidency.	.....	Mr. H. Seton Karr, M.P.
1 Skin of the Eastern Little Stint.	*Tringa ruficollis*	Capt. H. H. Harrington.
1 Skin of the Little Ringed Plover.	*Ægialitis dubia*	
2 Skins of the Bengal Bush Lark.	*Mirafra assamica*.....	
1 Skin of the Indian Pipit..	*Anthus rufulus*.....	
1 Skin of the Eastern Baya.	*Ploceus megarhynchus*	
1 Skin of the Striated Weaver Bird.	*Ploceus manyar*	

* Forwarded to the Victoria Gardens.

Contributions.	Description.	Contributors.
1 Skin of the Burmese Red Munia.	*Sporæginthus flavidiventris*..	Capt. H. H. Harrington.
2 Skins of the Pegu House Sparrow.	*Passer flaveolus*	
2 Skins of the Burmese Red-vented Bulbul.	*Molpastes burmanicus*	
1 Skin of the Burmese Shrike.	*Lanius colurioides*	
1 Skin of the Burmese Nuthatch.	*Sitta neglecta*	
2 Skins of the Burmese Spotted Babbler.	*Pellorneum subochraceum*...	
1 Common Snipe (albino).	*Gallinago cœlestis*	Capt. P. P. Kilkelly, I.M.S.

MINOR CONTRIBUTION.

From Mrs. A. K. Oliver.

CONTRIBUTION TO THE LIBRARY.

"The Butterflies of India, Burma and Ceylon," Vols. I, II, and III, by Marshall and de Nicéville. — Presented by Mr. C. Crommelin.

PAPERS READ.

The following papers were then read :—"On two Cetaceans from Travancore by H. S. Ferguson, with a Note on the same," by R. Lydekker, B.A., F.R.S., &c., in which a new porpoise or dolphin, named *Tursiops Fergusoni*, was described.

Mr. E. H. Aitken also read a paper on "The Butterflies of Bombay and the surrounding country" written by himself and Mr. E. Comber. The paper was made more interesting by specimens of the various butterflies being exhibited and referred to.

A vote of thanks was passed to the authors of the papers, and the meeting then terminated.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 5TH MARCH 1903.

The monthly meeting of the members of the Bombay Natural History Society was held at the Society's Rooms on Thursday, the 5th March 1903 ; His Excellency Lord Northcote presiding.

NEW MEMBERS.

The election of the following new members was announced :—

Mr. V. G. Morgan, I.F.S. (Hoshangabad, C.P.) ; Mr. H. H. Mann (Calcutta) ; Mr. J. E. C. Tukes, I.C.S. (Ahmedabad) ; Mr. E. H. Waterfield, I.C.S. (Kaira) ; Mr. J. T. Scotson, I.C.S. (Ahmedabad) ; Major R. H. G. Heygate, D.S.O. (Thayetmyo, Burma) ; Mr. W. M. Nuttall (Dibrugarh, Upper Assam) ; Mr. J. Malcolm Maclaren (Calcutta) ; Lieut. E. C. Coates (Ranikhet) ; Mr. R. H. Anderson (Dera Ismail Khan) ; Captain J. G. Hulbert, I.M.S.,

(Naini Tal U. P.); Captain G. C. Scott (Ceylon); Captain W. G. Liston, I.M.S. (Bombay); Colonel H. FitzGerald (Wellington, Madras); and Mr. John Glasser (Bombay).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary, Mr. W. S. Millard, acknowledged receipt of the following contributions since the last meeting :—

Contributions.	Description.	Contributors.
11 Fossils from the Gulf of Cambay.	.....	Mr. R. P. Lambert, D.S.P.
1 Skin of the Blue-breasted Banded Rail.	*Hypotænidia striata*	Mr. S. L. Whymper.
1 quantity of Butterflies from Cannanore and Kodaikanal.	.....	Capt. R. W. Burton.
2 Crested Buntings (alive)..	*Melophus melanicterus*	Mr. E. W. Harper, F.Z.S.
A quantity of Palæolithic implements from the Madras Presidency.	.....	Mr. H. Seton-Karr.
1 Young Jackal (alive).....	*Canis aureus*.....	Mr. W. E. Turner (H.M.S. "Highflyer.")
1 Golden Tree Snake (alive).	*Chrysopelea ornata*.....	Mr. A. M. Kinloch.
1 Green Tree Viper (alive)...	*Trimeresurus anamallensis*...	Do.
1 Snake	*Callophis trimaculatus*	Mr. R. H. Madan.
4 Red-billed Liothrix (alive)	*Liothrix lutea*	Mr. E. W. Harper, F.Z.S.
2 Silver-eared Mesias (alive)	*Mesia argentauris*	
2 Blue-winged Sivas (alive).	*Siva cyanuroptera*	
2 Black-crested Yellow Bulbuls (alive).	*Otocompsa flaviventris*	
2 White-eared Bulbuls (alive).	*Molpastes leucotis*	

Minor contributions from Mr. A. Forbes, Mr. F. A. Reddie, Colonel C. T. Peters, I.M.S. (Retired), and Major W. B. Bannerman, I.M.S.

CONTRIBUTIONS TO THE LIBRARY.

Moore's "Lepidoptera Indica," Vols. I, II, III, IV, and 5 parts of Vol. V. Presented by H. H. the Maharaja of Mysore.

"The Birds of Pekin," by Captain H. J. Walton, I.M.S., presented by the author.

"Journal of the Asiatic Society of Bengal," Vol. LXXI, Part II, No. 3, 1902, in exchange.

"On the Silver Pheasants of Burmah," by E. W. Oates, F.Z.S. Presented by the author.

"Text-book of Entomology" (Packard). Presented by Mr. J. F. Jowett.

THE ACCOUNTS FOR 1902.

Mr. N. C. Macleod, the Honorary Treasurer, placed before the meeting a statement of accounts for the year ending 31st December 1902, showing an income of Rs. 11,586 ; expenditure, Rs. 11,032 ; and a balance at credit of Rs. 1,562. He explained that the reason the income was smaller than previous years was due to a larger number of members having omitted to pay their subscriptions, and hoped that they would pay them without any further delay. It was resolved that the accounts be passed, subject to the usual audit.

PAPERS READ.

The following papers were then read and discussed:—1. "Fleas and the Plague," by Captain W. G. Liston, I.M.S., illustrated by a number of enlarged sketches, tables of experiments and microscopical specimens shewing the human flea, the rat flea and a transverse section of a flea, containing the plague germs. 2. "Size of Remarkable Trees," by G. Marshall Woodrow. 3. "Food of Centipedes," by W. P. Okeden. 4. "Note on the breeding of certain Herons, etc., in Southern India," by Captain H. N. Packard, R.A. 5. "The Common Snakes of Bombay," by the Revd. F. Dreckmann, S.J., and W. S. Millard, which was illustrated by some excellent sketches made by Mr. P. Gerhardt shewing the distinguishing features between poisonous and harmless snakes in which some similarity exists in colour, markings and general appearance.

Most of the papers will appear in full in the Society's Journal

PROCEEDINGS

OF THE MEETING HELD ON 16TH APRIL 1903.

The monthly meeting of the members of the Bombay Natural History Society was held at the Society's Rooms on Thursday, the 16th April 1903; Mr. J. Sanders Slater presiding.

NEW MEMBERS.

The Honorary Secretary, Mr. W. S. Millard, said it was gratifying to observe how members had responded to the appeal to obtain new members, and he was glad to announce that since the commencement of the year seventy-three new members had been elected. The committee sincerely hoped that members would not slacken their efforts, as it was desirable to obtain as many members as possible, and thus enable the Society to spend more money on the journal, especially as the coloured illustrations of Indian Ducks which are so much appreciated are so very expensive.

The election of the following new members was announced:—Lieutenant J. P. Stockley (Kherwara); Mr. R. Galloway (Secunderabad); Mr. A. H. Bell (Sirsa, Punjab); Mr. R. B. McCorinack (Ghansur, Seoni Chappara); Mr. H. H. Hayden (Calcutta); Lieutenant C. T. Simcox (Lucknow); Mr. D. L. McCarrison (Koraput); Mr. W. Moore, F.J.C. (Dibrugarh, Assam); Mr. N. S. Mondy (Dibrugarh, Assam); Dr. Manilal G. Desai (Kaira); Major F. R. Ozzard, I.M.S. (Tongshan, N. China); Lieutenant F. Stanley Clarke (Tongshan, N. China); Mr. L. O. Clark, I.C.S. (Lushai Hills, Aijal, Assam); Lieutenant L. L. G. Thorpe, R.A.M.C. (Colaba); Colonel A. E. Ward (Kashmir); Mr. W. H. L. Cabell, B.A., I.C.S. (Rangoon); Dr. R. Row, M.D. (London), (Bombay); Major J. Manners Smith, V.C., C.I.E. (Neemuch, C.I.); Mrs. L. Dalrymple-Hay (Nellore, Madras); Mr. W. Raby Noble (Behali, P. O. Assam); Mr. A. J. R. Hope (Myitkyina, U. Burma); Mr. K. Bernhardt (Karachi); Lieutenant W. F. Maxwell, R.E. (Aden); Captain C. Hodgkinson (Lucknow) and Mr. W. J. F. Williamson (Bangkok).

CONTRIBUTIONS TO THE MUSEUM.

The Honorary Secretary acknowledged receipt of the following contributions since the last meeting:—

Contribution.	Description.	Contributor.
Some Butterflies, mounted on plaster of Paris.	.....	Mrs. K. Thomson.
1 Crested Bunting (alive) ...	*Melophus melanicterus*	Mr. E. W. Harper, F.Z.S.
1 Snake (alive) juv.	*Gongylophis conicus*	Mrs. C. Hudson.
1 Phursa (alive) juv.	*Echis carinata*	Do.
1 Eastern Purple Heron.....	*Ardea manilensis*	Mr. B. A. Gupte.
3 Argus Pheasants	*Argusianus argus*	Mr. R. Laird (through Mr. A. D. Neubronner).
1 Snake (alive)..... ..	*Polyodontophis subpunctatus*	Capt. N. S. H. Sitwell, R.A.
1 Small Indian Eagle.....	*Aquila hastata*	Mr. W. D. Cumming.
1 Noddy.....	*Anous stolidus*	Do.
1 Do.	*Do.*	Do.
1 Red-breasted Merganser...	*Merganser serrator*.....	Do.
1 Indian Ring Dove	*Turtur risorius*.....	Do.
1 Sparrow Hawk.....	*Accipiter nisus*.....	Do.
1 Spotted Sand-grouse	*Pterocluras senegallus*	Do.
1 Coronetted Sand-grouse ...	*Pterocles coronatus*	Do.
1 Grey-necked Bunting	*Emberiza Buchanani*	Do.
1 Bonellis Eagle	*Hieractus fasciatus*.....	Do.
1 Indian Tawny Eagle	*Aquila vindhiana*	Capt. J. Watson, I.M.S.
1 Common Wood-Shrike.....	*Tephrodornis pondicerianus*	Do.
1 Indian Wren Warbler.....	*Prinia inornata*	Do.
The Ibis-bill	*Ibidorhynchus struthersi* ...	Mr. J. C. H. Mitchell.
1 Snake	.....	Do.
2 Eggs of the Indian Spur-winged Plover.	*Hoplopterus ventralis*.....	Do.
2 Eggs of the small Swallow Plover.	*Glareola lactea*.....	Do.
A quantity of Marine shells and fossils from the Mekran Coast.	.....	Mr. B. A. Gupte, F.Z.S.
1 Snake (alive)	*Oligodon subgriseus*.....	Mrs. C. Hudson.
1 Snake (alive)	*Typhlops brahminus*	Mr. S. F. Pearcey.
116 Birds' skins from the Shan States Frontier.	.....	Capt. H. Wood, R.E.
1 Barn Owl or Screech Owl.	*Strix flammia*	Mr. T. B. Bell.
1 Nest of the Spotted-Grey Creeper.	*Salpornis spilonota*	Do.
1 Skull of the Indian Chevrotain or Mouse-deer.	*Tragulus meminna*	Major R. Hall, R.A.M.C.
1 White-cheeked Bulbul (alive).	*Molpastes leucogenys*	Mr. G. C. Rehling.
1 Houbara (alive)	*Houbara macqueeni*.....	Mr. W. C. Constable, R.I.M.

Minor contribution from Col. H. H. Barnet, R.E.

Contributions to the Library were received from H. H. the Maharajah of Mysore, Mr. E. H. Aitken, Mr. Edward B. Poulton, and Mr. G. Claridge.

EXHIBITS.

A splendid specimen of the Argus Pheasant (*Argusianus argus*) presented by Mr. Laird was exhibited by Mr. E. L. Barton, who had mounted it for the Society. It was greatly admired by all present and will prove a permanent ornament to the Museum. A vote of thanks was passed to Mr. Barton

for his valuable work. Mr. E. L. Barton also exhibited a shooting seat which he had invented, and which was specially intended for duck shooting in places where there was a good deal of water, and in rushes at the edges of tanks, &c. The seat does not sink into mud, and as it revolves on a swivel it is of great use in duck driving, flighting, &c.

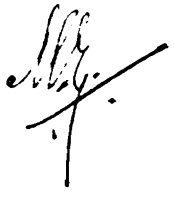
PAPER READ.

Mr. E. Comber read an interesting paper on "The Argus Pheasant" in which he referred to the curious habits of the bird and its wonderful plumage.

A COLLECTION OF MOSQUITOES.

Mr. E. H. Aitken said that it was proposed to make as complete a collection as possible of the mosquitoes of India, and the Committee hoped that members would help by sending them specimens of the kinds which paid them attention. The importance of a knowledge of the different species of mosquitoes could scarcely be exaggerated in the light of recent discoveries; but of the many medical men in India whom it concerned to know them, few had the opportunity or time to make large collections, and without a reference collection, identification was very difficult if not impossible. To make and keep such collection would be altogether in line with the honourable career of usefulness which has distinguished the Society in the past, and there could be no question that it ought to be commenced at once. Mr. Aitken then showed how mosquitoes were killed, pinned and preserved, and said if members were not disposed to take the trouble of performing the operation themselves they might send live mosquitoes to the Secretary in small bottles or glass tubes.

A vote of thanks was passed to Mr. Comber and Mr. Aitken, and the meeting then terminated.



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